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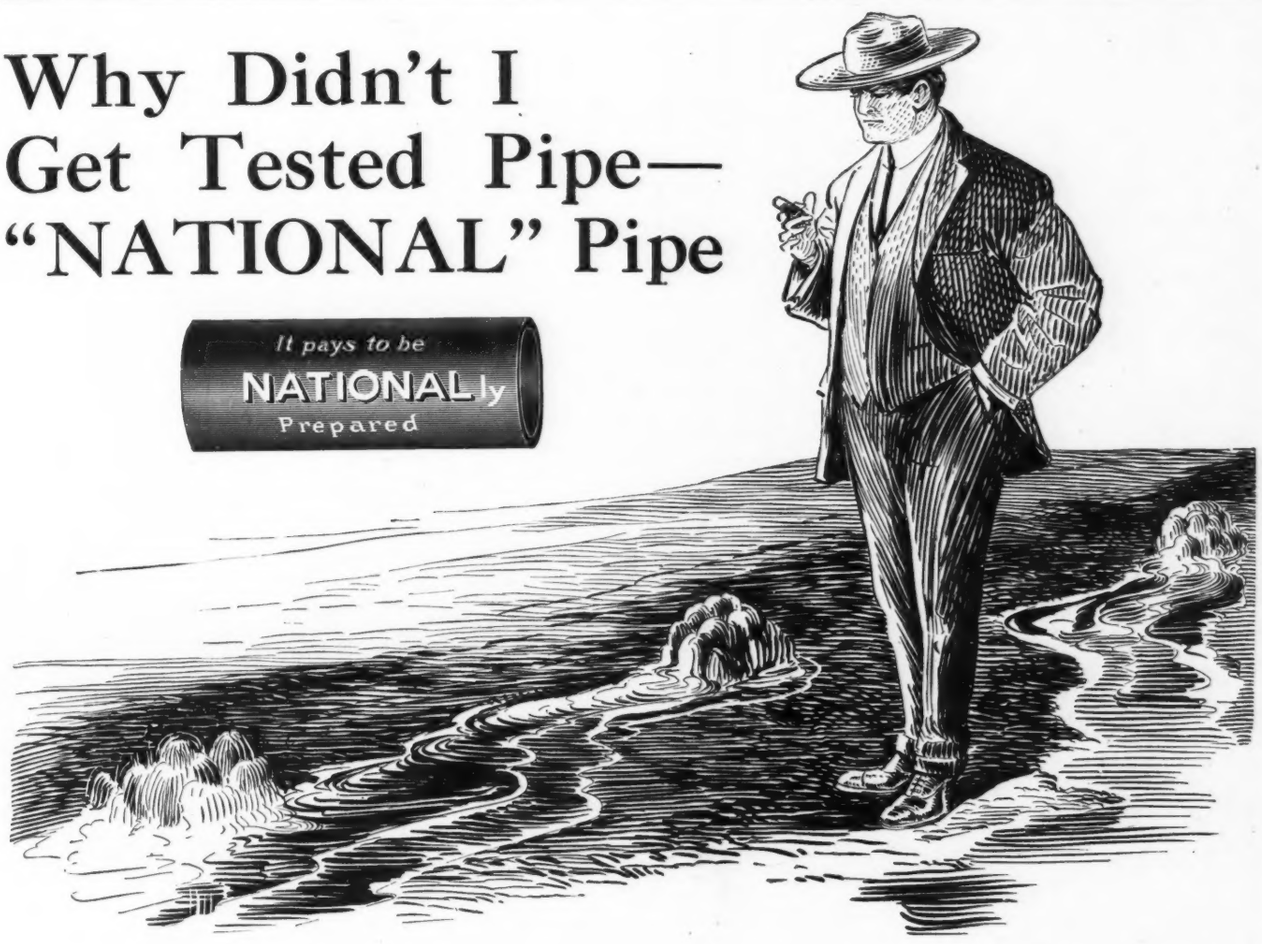
Why Didn't I Get Tested Pipe— "NATIONAL" Pipe



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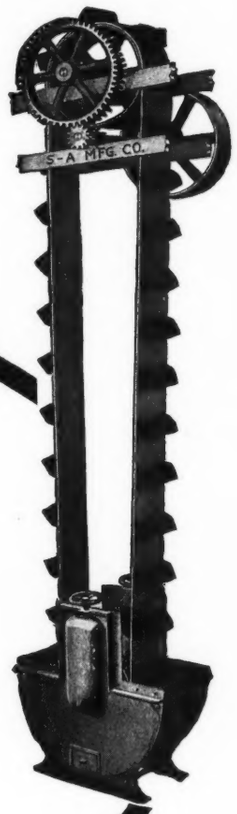

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Engineering and Mining Journal

VOLUME 103 JUNE 16, 1917 NUMBER 24

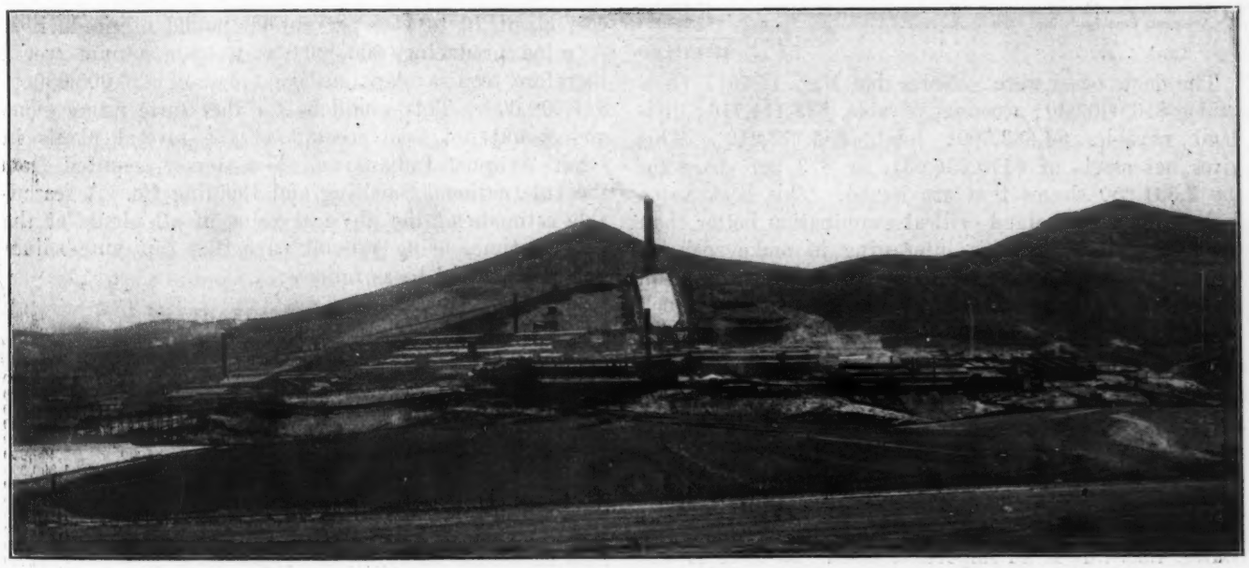
Anaconda's Finances

By W. R. Ingalls

SYNOPSIS—A study in mining and metallurgical finance, especially that of the Anaconda Copper Mining Co., based upon its annual report for 1916 with the assistance of previous reports and other published data. The conclusion is reached that the company, which estimates a book value of $73 per share for its assets, greatly undervalues its plants and investments, and so long as the copper mines of Butte maintain their production, the company has put itself in a position to earn $10 per share under what may be considered normal conditions in the copper and zinc markets.

The report of the Anaconda Copper Mining Co. is always of unusual interest owing to the unique position of the company. Among its peers, Utah is only a mining company, which does not even smelt its own ore. Phelps, Dodge & Co. is a great mining and metallurgical company, but it does not refine its product. The American Smelting and Refining Co. is a great metallurgical company with important mining interests. The Anaconda is the only one of these companies with a perfectly integrated business. Based primarily upon the Butte mines, it has become a great metallurgical company, rivalling the American Smelting and Refining Co., and not only does it do everything needful on its own account up to the marketing of its refined products, but also it does an immense business—metallurgical, manufacturing and mercantile—for other concerns and with the public.

We doubt if many of the stockholders, 20,000 and more, of this company have any adequate idea of the extent and diversity of their business. Their company owns the controlling interest in a railway, having 72 miles of track, which carries its ores and supplies and also the freight and passenger traffic between two important cities of Montana. In 1916 the railway company earned $527,167 net and paid $300,000 in dividends. The Anaconda company owns coal mines from which about 250,000 tons of coal were sold to the public in 1916, besides supplying the company's own requirements. Similarly it owns sawmills from which 80,000,000 ft. were sold commercially in 1916. Besides these, it owns the municipal electric light, street railway and water services at Anaconda, and operates hotels, farms, firebrick factories and one of the largest, best equipped foundry and machine shops west of the Mississippi River, in which it manufactures mining machinery for its own use and for sale to other mining companies. These subsidiary departments, not including the railway, earned a profit of $1,295,000 in 1916. In Butte, Anaconda and elsewhere, the company conducts a large and profitable mercantile business, the scope and magnitude of which would surprise the uninitiated.



WASHOE REDUCTION WORKS OF THE ANACONDA COPPER MINING CO.

Production in 1916—The Anaconda copper smelteries at Anaconda and Great Falls in 1916 treated 725,000 tons of ore for other companies; its zinc plants, 54,000 tons. Its smeltery at Tooele, Utah, did 864,000 tons. That at Miami, Ariz., 334,000. Here is a total of nearly 2,000,000 tons of custom business, which in point of tonnage is 40% of what was done by the American Smelting and Refining Co. in 1916. With the Anaconda's own tonnage of 5,400,000, the grand total is the largest handling of any metallurgical company other than iron and steel. The production of refined lead was 54,000 tons; of antimonial lead, 7800 tons; of refined copper, 590,000,000 lb. The company's own production of copper having been 307,395,000 lb., it follows that it refined upward of 140,000 tons for other concerns, of most of which it had also the selling. It produced upward of 10,000 tons of high-grade spelter in 1916, which will be increased to 35,000 tons in 1917 and then to 50,000. It makes a large tonnage of sulphuric acid, mostly for its own use, and in its several plants recovers a variety of byproducts, which it sells.

Book Assets—As for mines, it owns the major part of the Butte district and some isolated properties in various parts of Montana. In Chile, it owns a copper mine with a developed orebody of about the size and grade of that of the Inspiration. It owns 200,000 shares of Inspiration stock; 56,900 of Greene Cananea; 12,750 of Butte, Anaconda & Pacific, and other stocks and bonds of great value. It is interesting to see how these assets are figured in the balance sheet. The company summarizes them, together with its current assets, as follows:

1.	Mines, water rights and real estate	$74,687,054
2.	Plants	47,303,134
3.	Timber lands	5,499,957
4.	Investments in other companies	18,936,376
5.	Supplies and prepaid expenses	7,317,431
6.	Merchandise for sale	978,231
7.	Metals in process and on hand	37,225,804
8.	Accounts receivable and cash	32,065,854
	Total	$224,913,841

The debts owed were: Notes due Mar. 1, 1917 (now paid), $16,000,000; accounts payable, $33,114,710; dividend payable, $4,662,500; total, $53,777,210. This gives net assets of $170,236,631, or $73 per share for the 2,331,250 shares that are issued. This book value will, perhaps, withstand critical examination better than most book values. It is interesting to make such an examination by study of the data that are to be found in the series of annual reports of the company and such technical data as are to be found in the *Engineering and Mining Journal*. It would, of course, be nonsensical to think of attempting any minute appraisal in this way, but by thinking broadly we can, perhaps, check up roughly the main heads in the company's balance sheet.

The items of uncertainty are manifestly the first four. Of these we must dismiss the third—timber lands—having no means of checking it. We know, of course, that this is an important asset. In 1910 it was estimated that the timber supply was sufficient to last, at the rate of consumption at that time, for at least 50 years.

Investments in Other Companies—Of the item of $18,936,376 for investments in other companies "not entirely owned" by Anaconda, $7,968,836 was expended in 1916 for 20,740 shares of Alice Gold and Silver Mining Co.; 26,100 of Greene Cananea; 50,000 of Inspiration; 188,300 of Butte Copper and Zinc Co. and the "total cost of the stock of the Andes Copper Co. acquired to Dec. 31, 1916." There was, therefore, $10,967,540 invested previous to 1916. We know from earlier reports that 150,000 shares of Inspiration cost $3,000,000. The purchases of Inspiration in 1916 must have been made between $42⅝ and $74¾ per share. It is reasonably safe to assume that they were not made in the neighborhood of the latter and at the present price of about $55 perhaps they show neither much profit nor loss, but at $55 the shares previously purchased show an appreciation of $5,250,000. (It has been unofficially reported that the Inspiration stock bought in 1916 cost about $49 per share and the Greene Cananea about $46.)

The most important thing about Anaconda's investment account is the Andes mine. It is a clear deduction from the statements in the last report that this stock can not have cost more than $4,000,000 up to the end of 1916. For that sum has been acquired a mine of the same order as Inspiration. At $55 per share, Inspiration is valued at $65,000,000, and it has been computed to have a liquidating value in excess of that on the basis of 15c. for copper. That valuation includes, of course, the considerations that it is equipped and is a going concern, paying dividends. It may be reckoned roughly that it will cost $15,000,000 to put Andes in the way of producing 100,000,000 lb. of copper per annum and if we discount the period of five, six or seven years before the mine is put on a paying basis by the deduction of $20,000,000 more, it is probable that Anaconda has acquired an orebody worth as much as $30,000,000 for the cost of $4,000,000, say, which stands in the books.

Value of Plants—With regard to plants, at first sight the total of $47,303,134 appears to have been written down, by annual deductions for depreciation, to a figure that is below their present worth or cost of replacement. The equipment of a copper mine even before the war cost about 12 to 15c. per annual pound of production. A mine producing 300,000,000 lb. per annum would therefore require plant outlay at cost of $36,000,000 to $45,000,000. This would be for the Butte mines alone and would not take account of the several plants in Utah, Arizona, Indiana and New Jersey acquired from the International Smelting and Refining Co. A reasonable estimate of the physical value of all plants at the present time, using present capacities but ante-bellum unit costs would be as follows:

METALLURGICAL PLANTS

		Annual Capacity	Unit	Value
Anaconda copper concentrator	*a*	3,000,000 tons	@ $1.25	$3,750,000
Anaconda zinc concentrator	*a*	700,000 tons	@ 1.25	875,000
Anaconda leaching plant	*a*	600,000 tons	@ 1.50	900,000
Anaconda smeltery	*a*	3,500,000 tons	@ 4.00	14,000,000
Anaconda acid plant	*b*	60,000 tons	@ 10.00	600,000
Great Falls smeltery	*a*	400,000 tons	@ 6.00	2,400,000
Great Falls copper refinery	*c*	90,000 tons	@ 20.00	1,800,000
Great Falls zinc works	*c*	50,000 tons	@ 55.00	2,750,000
Tooele copper smeltery	*a*	550,000 tons	@ 5.00	2,750,000
Tooele lead smeltery	*a*	600,000 tons	@ 3.00	1,800,000
Miami smeltery	*a*	750,000 tons	@ 4.00	3,000,000
East Chicago lead refinery	*c*	60,000 tons	@ 8.00	480,000
Perth Amboy copper refinery	*c*	230,000 tons	@ 20.00	4,600,000
Total metallurgical plants				$39,705,000

MINING PLANTS (SURFACE WORKS)

Copper and zinc mines	*a*	5,600,000 tons	@ $1.50	$8,400,000
Coal mines				1,000,000
Total mining plants				$9,400,000

OTHER PLANTS

Lumber mills	$2,000,000
Foundries	250,000
Brick factories	400,000
Public utilities	1,000,000
Total of other plants	$3,650,000

SUMMARY

Metallurgical plants	$39,750,000
Mining plants	9,400,000
Other plants	3,650,000
	$52,755,000

a Tons of ore. *b* Tons of sulphuric acid of 60 deg. B. *c* Tons of metal product

In computing the above items, we take capacities as given in the *Engineering and Mining Journal,* together with statements in the company's last report of work actually done. For the value of the coal-mining plants and "other plants" we can do nothing but guess, but inasmuch as the total for these is less than 10% of the grand total, our guesses may be wild without influencing the grand total very much. As for the metallurgical and mining plants (other than coal) there are probably some figures that are over and some that are under the actual costs, and without any doubt there are more that are under than over, for we have figured unit costs as they were before the war, while some of these constructions—the zinc plant, for example—have been done when prices were highest and surely have been more costly. However, we feel considerable confidence in our summation that the replacement value of the plants of the Anaconda company was at least $53,000,000 according to prices prevailing before the war. In the company's books they were carried at about $47,000,000 at the end of 1916.

Historical Summary of Book Valuations—Another way of forming an idea of the present book valuation is to follow the mutations of this account since 1909. At the end of that year the several companies—Anaconda, Boston & Montana, Washoe, Trenton, Parrot, Butte & Boston, Diamond Coal and Coke and Big Blackfoot Lumber Co.—that were united in 1910 reported aggregate assets as follows: Copper mines and lands, about $32,400,000; coal mines and lands, $1,431,450; timber lands ("at cost"), $23,384,344; a grand total of about $57,000,000. The mines of the Red Metal Mining Co., which had been purchased from Heinze with about $11,000,000, and those that were purchased from W. A. Clark for $5,000,000 in 1910 would raise the total to $73,000,000, which is about $1,000,000 less than the Anaconda reported for mines plus timber lands at the end of 1910. There was clearly some revaluation of both mines and timber lands following the absorptions in 1910.

Plants at the end of 1909 stood at about $5,500,000 for the copper mines (exclusive of Red Metal), $335,000 for the coal mines, $950,000 for the lumber mills, etc., $2,024,726 for the metallurgical works at Great Falls, and $4,906,711 for the Washoe works, which had been written down to that figure from their cost of $10,753,013. The total book value of plant was, therefore, about $13,700,000. At the end of 1910 it was given at about $15,000,000. Allowing for the Red Metal mine plants, which we have been unable to separate from the mines themselves and allowing for additions that may have been made in 1910, the accounting for the book value at the end of that year is near enough. If all of the constituent items were valued so conservatively as the Washoe and Great Falls works no criticism is to be offered. At this time the Butte mines were producing about 3,800,000 tons of ore per annum. Their equipment, on the basis of actual production, represented therefore about $1.45 per ton of annual capacity. These are large and deep mines, there are many of them, and their equipment is necessarily more costly than anything we can think of outside of the Lake Superior district.

The investment in other companies reported at the end of 1909 were the following: Butte Water Co., $862,971; Montana Water, Electric Power and Mining Co., $222,860; the Hennessey properties, $681,879; Washoe coke department, $765,743; Washoe coal department, $408,742; Bridgeport Copper Co., $45,228; J. T. Carroll Lumber Co., $12,800; Hope Lumber Mfg. Co., $263,756; investments of the Anaconda Copper Mining Co., $534,008; total, about $3,800,000. At the end of 1910 investments were reported at $4,301,661. The interest in the Butte, Anaconda & Pacific railway inferentially is included in the unenumerated investments of the original Anaconda company. At this time Anaconda owned 51% of the $1,000,000 of capital stock of the railway company. Subsequently the capital of the railway was increased to $2,500,000, a stock dividend being declared, whereof Anaconda received its pro rata.

The copper mines of the Anaconda company at the end of 1909 were producing about 225,000,000 lb. of copper per annum. According to the several valuations before the consolidation, the total was about 23c. per pound of annual product. On the subsequent valuation of $67,781,000, when the timber lands had been segregated as $5,955,719, it was about 30c. It may be remarked that the company had actually paid $16,000,000 in cash for two groups of mines—the Heinze and Clark—both much less important than its own, within a few years immediately preceding. It may be further mentioned that up to the end of 1911 the properties originally acquired by the Amalgamated Copper Co. in 1899 had been written down by $31,410,056.

The fixed assets reported by the Anaconda company since 1909 are summarized in the following table:

FIXED ASSETS AS OFFICIALLY REPORTED

End of	Mines	Plant	Timber	Investments
1910	$67,781,508	$15,039,183	$5,955,719	$4,301,661
1911	67,652,350	15,938,493	6,011,238	5,426,398
1912	68,204,021	16,169,125	5,915,299	6,289,350
1913	68,689,660	16,965,561	5,860,996	7,084,202
1914	71,686,262	31,896,252	5,689,942	5,211,727
1915	72,636,898	40,074,652	5,542,524	11,153,959
1916	74,687,054	47,303,134	5,499,957	18,936,375

Value of the Butte Mines—Up to 1914, the book value of the mines experienced but little change. The annual reports of the company throw no light on this subject. The Southern Cross mine at Georgetown, Mont., was purchased in 1911, but probably was not paid for until 1912, when there was a jump of about $500,000 in total book value. The jumps of $3,000,000 for 1913 to 1914 are unexplained; nor is the jump of $1,000,000 in 1915. The increase of $2,000,000 in 1916 is accounted for in the last report, chiefly by the purchase of the Pilot Butte Mining Co. and the Alex Scott and Little Annie claims. Undoubtedly, the company has been buying mines right along and adding them at cost price to assets. Whether it has deducted anything for depletion of mines, or has reckoned that developments and acquisitions have maintained their resources, is uncertain, but probably that has been the theory. The Butte mines are incapable of blocking out like flat-lying deposits. They have to be viewed broadly on the basis of probability, taking into consideration that they are not merely a group of mines, but are practically all the mines of an immense district. Seven years of production has not *apparently* impaired their prospects. In 1916, they produced about 300,000,000 lb. of copper. On the same basis of 30c. per annual pound, as in 1910, their present value would be $90,000,000. Whether it really is so, or not, is not

for us to pronounce. In an article in the *Engineering and Mining Journal* in the early part of 1912, it was estimated that the Anaconda mines could probably be counted upon to maintain their production at the rate of about 300,000,000 lb. of copper per annum if the orebodies should continue in undiminished magnitude and grade to the depth of 3100 ft. At that time a depth of 2800 ft. had been attained in one mine, and it was added: "An expectation that payable ore will extend to that depth (3100 ft.) does not either stretch imagination or violate reason." At the present time the ore-bearing veins have been cut on the 3200-ft. level, and openings are being made on the 3400-ft. level.

Changes in Plant Valuations—The status of plant value, according to the company, experienced only a moderate increase up to the end of 1913. This probably represented money actually put into them, less writing-off for depreciation, which began in 1912 when about $1,000,000 was written off; in 1913 the amount was $727,000; in 1914 it was $845,000; in 1915 it was $1,900,000 and in 1916, the immense sum of $7,113,463.

The jump of about $15,000,000 in 1914 was due partly to the plants of the International Smelting and Refining Co., acquired during that year and partly to the vast program of expansion and improvement at Anaconda and Great Falls instituted early in the same year. The book value of the International plants at the end of 1913 was $13,750,000. In 1914-16, there was expended for improvements and extension, chiefly at Anaconda and Great Falls, the sum of $13,646,000.

Investment Accounts—The matter of investments is not easy to trace. Up to the end of 1914, there was no spectacular expansion. This account had risen to about $7,000,000 in 1913 and declined to about $5,200,000 in 1914. In 1915, there was purchased from the Amalgamated Copper Co., 150,000 shares of Inspiration, 30,800 of Greene Cananea and 1110 of Mountain Trading Co. for $4,769,900. This falls more than $1,000,000 short of accounting for the increase in the investment account for that year, the difference being, no doubt, attributable to other purchases. During the same year, the company bought the business of the United Metals Selling Co. for $6,624,583, which manifestly does not appear in its investment account. Indeed, it seems to have been the policy of the company right along to absorb new property into its main grouping of assets. Thus, stock in some company is bought and carried in "Investments." Later, the remaining stock might be bought and the account of the whole thing removed from "Investments," and divided between "Mines" and "Plants." When the United Metals Selling Co. was acquired, it had only contracts and liquid assets, the latter being added to the Anaconda's current assets, the contracts, etc., not being capitalized.

Earnings in 1916—But commercial property is valuable only for what it produces, or can produce. Let us turn to the profit and loss statement of Anaconda for 1916. That showed a profit of $50,828,372 for the year after the enormous sum of $7,113,463 had been written off for depreciation of plants. Of that profit $2,350,641 came from other investments, $1,981,188 from the sale of merchandize, and the remainder from the production of copper, zinc, silver, gold, etc., from royalties and rentals, from the smelting and refining of ores on toll and from the selling of metals on commission. A change in the methods of book-keeping expanded the 1916 profit about $7,000,000, which might theoretically be charged back to 1915. The actual profit for 1916 was therefore about $44,000,000.

Using that figure as a basis, the profit for the first half of 1917 should be proportionally more, copper and lead having both sold at higher prices, while the production of zinc has been greatly increased, interest on the $16,000,000 of notes has been saved, interest on accumulated surplus has been realized, and there has been no occasion for another writing off for depreciation and obsolescence of plant so large as in 1916. In making the enormous deduction in 1916 the company wrote off plant that is still in use, but that probably will be thrown away after the present demand upon full capacity has ceased. On the other hand, allowance must be made for greatly increased taxes in 1917.

Estimate of Normal Earning Capacity—The figures for 1916 are interesting in their exhibition of huge profits in an exceptional year and the derivation of those profits, but manifestly they are no safe criterion for what may be expected in years to come. With their guidance, together with that of previous reports, let us try to conjecture what might be expected in a sober year. Let us assume that the company might be able to sell at 15c. the output of 250,000,000 lb. of copper costing 10c. per lb., gold and silver proceeds being absorbed in that figure. It is likely that with this method of figuring the company can really produce copper at less than 10c. per lb., but we will stick to that figure so as to let the estimate be safe for an average price of less than 15c. for copper. Let us assume that the company can produce and sell 50,000 tons of zinc at a profit of $40 per ton, byproducts again being absorbed. Let us assume further that it can for other people smelt 1,500,000 tons of ore at $2 per ton profit, refine 100,000 tons of copper at $5 and sell 200,000,000 lb. at 15c. less 1% commission, all of which is far below what was done in 1916. We might then expect a net income something like the following:

ESTIMATED NET INCOME

250,000,000 lb. copper @ 5c. profit	$12,500,000
50,000 tons zinc @ $40 profit	2,000,000
Tolls	3,500,000
Selling commissions	300,000
Rentals	70,000
Sales of merchandise	1,000,000
Dividends from Inspiration	1,600,000
Dividends from Greene-Cananea	114,000
Dividends from other investments	250,000
Interest	2,000,000
Total	$23,334,000

As to the last item—interest—at the end of 1916, Anaconda had accounts receivable and cash to the amount of $32,000,000. Since then, it has paid off $16,000,000 in notes, but by July 1 it will have added perhaps $24,000,000 out of the profits for first half of 1917, giving it cash resources of about $40,000,000, which may be reckoned as being worth $2,000,000 per annum in whatever way it be put to work. In subsequent annual reports, this may not appear as interest, probably it will have been put to work in diverse ways, but for the present estimate it is proper to figure it as interest.

Summary—A translation of this estimate is that by the middle of 1917 Anaconda should be in a position to earn $10 per share, if copper should thereafter sell at an average of 15c. per lb., if zinc should sell at prices prevailing before the war, if its custom smelting business should contract to 75% and its mercantile profits to 50% of what they were in 1916. Only a little more

than one-half the earnings would be derived from the copper mines at Butte. This brings us up to the all-important question: What is the liquidating value of the Butte mines? Unfortunately, no one can answer that question, for no one can say what their life and future will be.

Some things may be summarized from this exposition, as follows:

1. The company gives its assets a book value of $73 per share, of which about $47 per share may be assigned to the mines and metallurgical works in Montana.

2. All plants, in the aggregate, are valued at less than it would cost to duplicate them under ante-bellum conditions of construction.

3. Its investments in other companies have probably a market value of more than $14 per Anaconda share in excess of what the company allows for them.

4. By the middle of 1917 the company will be in a position to earn $10 per share under average market conditions existing before the war.

Trinitrotoluol

With the fall of Liege in 1914 the world at large became acquainted with a new and powerful military explosive whose cabalistic symbol, T.N.T., acquired a horrifying and world wide significance almost over night, according to B. C. Hesse.

Although then new to the world at large, T.N.T. was in reality known as early as 1863, but as a mere laboratory product: Its explosive properties were not recognized nor utilized until about 1880. Even then no particular attention was given to it as an explosive until about 1891, when factory methods for making it and suggestions for its wider use in the explosives field, military and otherwise, were published in Germany. It is described for explosives purposes in English text-books as early as 1896; Spain and France, prior to 1909, had introduced it into their military services and German manufacturers had long before that been engaged in introducing it into the military services of other countries.

This material, T.N.T., is neither difficult nor dangerous to make. It is transported with greater safety than almost any other high explosive. When compressed under 30,000 to 40,000 lb. per sq.in. it can be worked and cut into suitable forms. Loose, it is a white solid, half again as heavy as water, melts well below the boiling point of water and can then be filled into shells without danger from fumes or corrosion of the metal. It is slightly less powerful than picric acid and while the latter frequently pulverizes a shell, T.N.T. generally bursts the shell into fragments large enough to have a destructive effect. Like picric acid, it is exploded by means of a fulminate and does not, if pure or in proper form, explode of itself.

In treating toluol, a water-white liquid—a "chemical cousin" of benzol—with nitric acid, three general classes of compounds are obtained: Trinitrotoluol (T.N.T.), dinitrotoluol and mononitrotoluol. The last two are used in making dyes; trinitrotoluol is made by treating dinitrotoluol or mononitrotoluol with more nitric acid. Of the mononitrotoluol the dye maker uses two different kinds, designated as ortho and para mononitrotoluol respectively. In making the ortho variety it is always accompanied by more or less of the para variety, and the reverse is also true. At about the end of the nineties the situation was that more para was necessarily made than the world's dye-market could consume and more ortho could be used for dyes if it could be had without making more para, or if a new outlet for para could be found. At that time the German dye-makers were burdened with not less than 15,000 long tons of para for which they were unable to find any use. This para cost about $180 per long ton to make, and this surplus meant about $2,700,000 of idle money. Worse than that, this was irresistably growing at an alarming rate. Until about 1904 the German dye-makers were most energetically, almost frantically, endeavoring to find new outlets for this para in the dye business, but without any real success. Then this feverish activity stopped short, ominously so. Liege in 1914 gave the answer! These 15,000 tons of para and all surplus that was since made found their way into T.N.T. More than that, since 1904 or thereabouts the Germans have actually developed methods that gave much more para for a given weight of ortho than the older methods; they wanted this extra para for explosives!

That Germans have developed T.N.T. as an explosive rather than picric acid is a logical outcome of industrial conditions in Germany. Germany has never been as well placed as France, Belgium or Great Britain for large supplies of carbolic acid from which picric acid is generally made. As regards toluol, Germany has for years been better placed than these other countries. With this excess burden of para nitrotoluol on her dye-makers' hands Germany seems to have taken the line of least resistance and made the most of her situation. Clearly, the German dye-makers were actually driven into the explosives field, and seemingly they did not enter it as a result of any long-headed foresight on their part or on the part of their Government. It took them 31 years to get into the explosives field after the material for T.N.T. was accessible to them and to their government.

Oil-Burning Engines in Metal Mines

In order to secure first-hand information regarding the sizes of Diesel or other oil engines required in the metal-mining industry, the following questions were submitted to a number of operating companies:

What makes and sizes of Diesel or oil engines, if any, have you installed?

If you were about to install such an engine, what size or sizes would you require?

The wide range of units in use or which might be used to conform to power requirements of the companies replying, was somewhat startling, varying from 15 to 1500 hp. Sixty per cent. of the companies have no such equipment, and of those which have, the majority have units of less than 100 hp. In reply to the second question, 25% would require units of less than 100 hp., 5% between 100 and 200 hp., 10% between 200 and 300 hp., 20% between 400 and 500 hp., and 40% over 500 hp.

Replies from manufacturers as to what sizes they were selling show that the engine of over 400 hp. is more in demand than that of less power, 75% of sales having been of units of from 400 to 1250 hp. each, gasoline engines in all probabilities being used in place of oil engines in the smaller units.

The Proposed Corocoro Mill, Bolivia

By Mark R. Lamb*

SYNOPSIS—The Compañia Corocoro de Bolivia will construct a 1000-ton mill for treating ore containing native copper in sandstone. The copper is in the interstices of a very friable sandstone, so that the grinding process is one merely of disintegration. The mill will embody several unusual features.

The Corocoro company has a wide vein of native copper in sandstone. The ore when mined is soft, and even when dry is so weak that it disintegrates between the fingers. The copper is in the interstices of the sandstone, so that no grinding in the usual sense of the word is required—merely a disintegration. This softness upsets ordinary practice in several directions. Two 12 x 18-in. jaw crushers will be ample for the 1000 tons in 10 hours. The crushers must be proof against the very rare appearance of mass copper.

Since the headroom between the discharge of the ropeway and crushers is great, only small, coarse-ore bins can be used, and as the company recently experienced a serious fire, it would take considerable argument to convince them that steel is not better than wood for bins, building and framework.

The coarse ore from the tramway will be discharged through two apron feeders to the two crushers and thence conveyed by means of an inclined conveyor belt to the ball-mill bins. It is also desired that these bins should be of steel, unless the delivery is so late that it interferes with the prompt erection of the mill. These bins are to be made large enough to hold at least a 12-hour run and, if possible, more, since there is very little room for storage at the mine. The crushed ore from these bins will be fed by means of automatic feeders to six ball mills, approximately 5 ft. in diameter by 4 ft. long, to be driven by herringbone gear, chain or spur gear, this detail also depending upon deliveries.

It will be noted that, as there are only six ball mills, the capacity expected of them is extraordinarily large, but as has been explained already, there is really no crushing to be done, but only disintegration of a very weak sandstone.

Tailings Wheel for Pulp Elevators

As the mill is to be built on a flat site, the crushed product must be lifted for feeding to the various machines. F. A. Sundt, the manager, has a tailings wheel, made in Europe, that has been running now three years without requiring the least attention and that has afforded great relief from the difficulties experienced with other types of elevators before its installation. For this reason it is preferred to have two special wheels built in accordance with the design of the wheel now in operation. These wheels will each lift half of the pulp to some type of mechanical classifier, which will separate all the sand above 60-mesh for jig feed. I can hear many protests at jigging 60-mesh sands, but as this is a 60-mesh sandstone with practically no slime, and nothing over 60-mesh, and as the present practice is to jig the sand and the results are excellent, it is difficult to find a practical or theoretical reason for varying the process. It has been suggested that tables would be better than jigs for this work, but in the present plant treating 250 tons a day, where there are jigs and tables and where the feed to the jigs is not thoroughly free from slime, the jigs obtain 95% of the total mill recovery.

In order to make a complete recovery of the copper in the jig feed, shipping concentrates are not made in the first jigs, but are obtained from a cleaner jig that is provided for each four primary jigs. These cleaner jigs give 85 to 90% copper concentrates.

Going back to classification of pulp from the tailings wheel, the overflowing fine sands and slimes from the jig classifier will be taken to another mechanical classifier, which will remove the small amount of sand remaining, and separate the slimes for thickening, preparatory to being concentrated on tables or vanners.

In the mill at present in operation, the jig tailings, table tailings and slimer tailings are all of practically the same grade; that is, they contain from 0.2 to 0.3% of copper with a head assay of 2 to 3%.

It is expected that the improvement in classification will effect an improvement in extraction, not only in the jigs but on the tables and slimers, and for this purpose a mechanical classifier and a continuous mechanical thickener have been ordered for experiments in the old mill, and will replace the present spitzkasten, which are operated without the use of clear pressure water.

Exceedingly Small Mill for its Capacity

This mill will probably be the cheapest and smallest plant for the given capacity of any in the world, and this is due simply to the fact that the ore crushes very easily to a uniform size, as there is no slime in the original sandstone and what is produced is merely the result of "accident" in the mills.

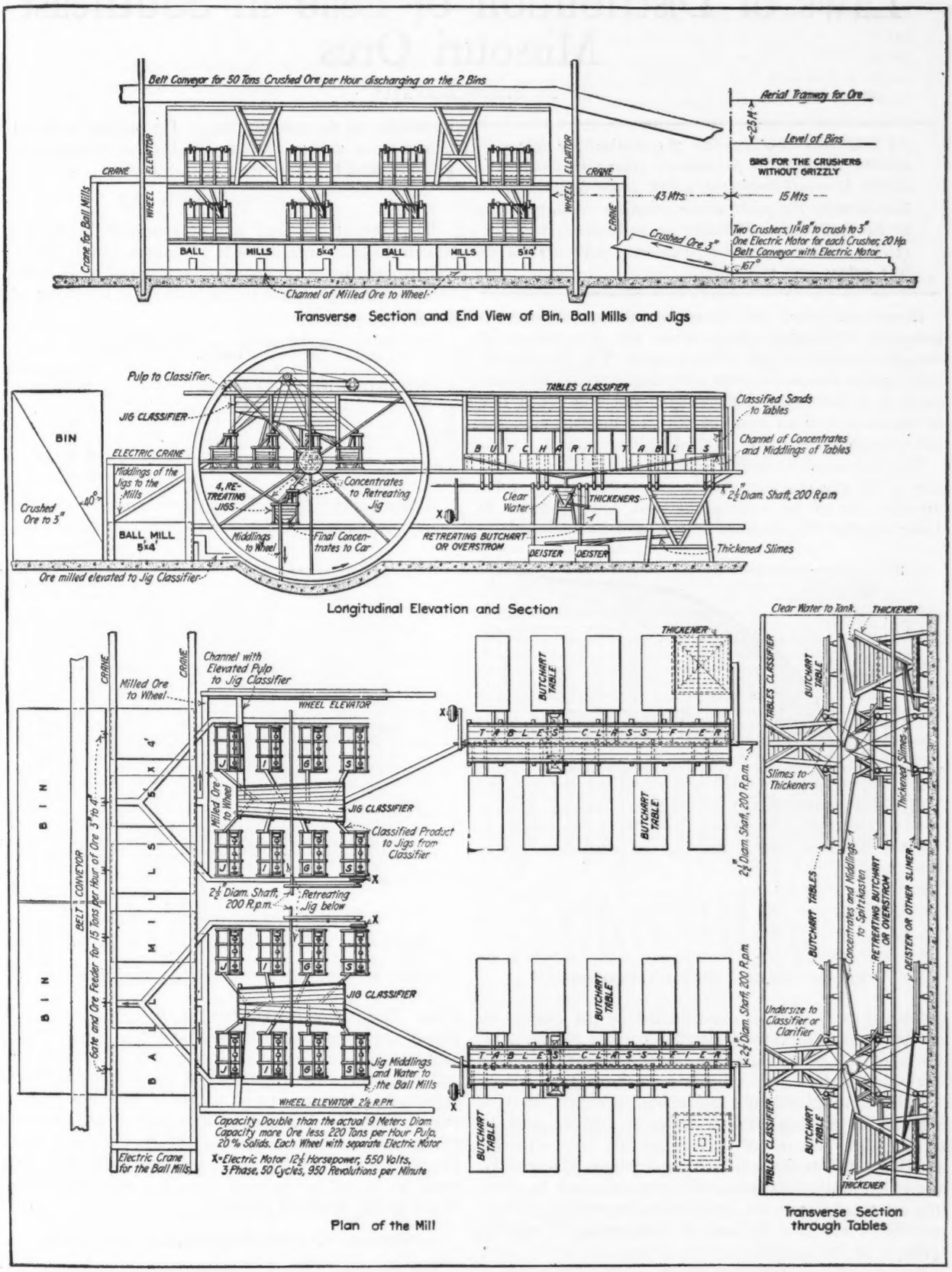
At present three light, primitive chilean mills are crushing 200 to 250 tons a day of this material, whereas on real rock they would net 30 tons.

Recently the properties of this company were examined by American engineers and a purchase very nearly consummated of all the important mines in the Corocoro district. The reason for the failure to complete the transaction was that the buyers would not buy one company alone and that the price of the two properties together was too high, in their estimation.

However, since the option has expired, a wide zone of sulphide ore has been uncovered, and heavy shipments are being made of run-of-mine ore that will very shortly produce more than the price asked for the mine. Furthermore, discoveries of similar formation have been made in both directions along the line of extension of the important mines, and it is expected that deposits equally important will be encountered.

In order to give an idea of the facility with which the native copper ores are concentrated as compared, for example, with native copper deposits of Lake Superior, I would hazard a guess that a ½% ore at Corocoro would be more profitable than 3% in Lake Superior, taking into consideration the cost of mining and concentration, and this in spite of the fact that Corocoro is a long way from the machinery and copper market.

*Metallurgical engineer, 30 Church St., New York.


Belt Conveyor for 50 Tons Crushed Ore per Hour discharging on the 2 Bins
Aerial Tramway for Ore
25 M
Level of Bins
BINS FOR THE CRUSHERS WITHOUT GRIZZLY
CRANE
WHEEL ELEVATOR
Crane for Ball Mills
43 Mts.
15 Mts
Crushed Ore 3"
Two Crushers, 11"×18" to crush to 3"
One Electric Motor for each Crusher, 20 Hp.
Belt Conveyor with Electric Motor
16°
BALL MILLS 5'x4'
Channel of Milled Ore to Wheel
Transverse Section and End View of Bin, Ball Mills and Jigs
Pulp to Classifier
TABLES CLASSIFIER
JIG CLASSIFIER
Classified Sands to Tables
BIN
ELECTRIC CRANE
Channel of Concentrates and Middlings of Tables
Middlings of the Jigs to the Mills
BUTCHART TABLES
Crushed Ore to 3"
40°
4, RE-TREATING JIGS
Concentrates to Retreating Jig
Clear Water
THICKENERS
2½" Diam. Shaft, 200 R.p.m.
BALL MILL 5'x4'
Middlings to Wheel
Final Concentrates to Car
RETREATING BUTCHART OR OVERSTROM
DEISTER
Thickened Slimes
Ore milled elevated to Jig Classifier
Longitudinal Elevation and Section
Clear Water to Tank
THICKENER
Channel with Elevated Pulp to Jig Classifier
Milled Ore to Wheel
BUTCHART TABLE
TABLES CLASSIFIER
Slimes to Thickeners
Thickened Slimes
JIG CLASSIFIER
Classified Product to Jigs from Classifier
Milled Ore to Wheel
2½" Diam. Shaft, 200 R.p.m.
Retreating Jig below
BUTCHART TABLES
Concentrates and Middlings to Spitzkasten
RETREATING BUTCHART OR OVERSTROM
DEISTER OR OTHER SLIMER
Undersize to Classifier or Clarifier
Jig Middlings and Water to the Ball Mills
WHEEL ELEVATOR 2½ R.P.M.
Capacity Double than the actual 9 Meters Diam.
Capacity more Ore less 220 Tons per Hour Pulp, 20% Solids. Each Wheel with separate Electric Motor
X=Electric Motor 12½ Horsepower, 550 Volts, 3 Phase, 50 Cycles, 950 Revolutions per Minute
Electric Crane for the Ball Mills
BELT CONVEYOR
Gate and Ore Feeder for 15 Tons per Hour of Ore 3" to 4"
Plan of the Mill
Transverse Section through Tables

DRAWING SHOWING THE LAYOUT OF THE PROPOSED COROCORO MILL

The equipment to be employed at the Corocoro mill is shown, and its location in the plant fixed. The interesting details, such as the jigs, the tailings wheel for elevating the pulp, classifiers and concentrating tables, are shown in their proper location in the mill. The general arrangement is so shown that the flow of pulp can be followed

Laws of Distribution of Lead in Southeast Missouri Ores

By Sergio Bagnara*

SYNOPSIS—A discussion of a method for determining the relative fineness of galena in gangue in the Missouri lead ores, which could be applied to determine the point where grinding would cease to be profitable. The use of methylene iodide (CH_2I_2) is described in separation of gangue from free galena and middlings.

Screen analyses as performed for milling purposes are generally of relative value when the distribution of metallic contents of each size is sought. The only specific information obtainable from a screening test is the composition of the material by weight, and even when this is combined with an assay of the base on each size, the information derived is of limited milling value.

The millman is little interested to know that a certain size of his ore contains such a percentage of the total metallic run of his milling material, but he wants to know whether this amount is free and immediately recoverable, or if it is so disseminated in the gangue as not to warrant mill treatment for further recovery, or else whether a reduction of the size will set more mineral in the free state.

This information is obtainable from a screen classifying analysis showing the distribution of metallic contents in the three classes of mill material—free mineral, middlings and tailings. Such an analysis, if correctly and scientifically conducted, will generally lead to absolute valuable information, and within the limit of milling practice it will give the laws of distribution of metallic contents in the gangue.

This test is specially important on the disseminated lead ores of southeast Missouri, where the mill treatment has its main problems in grinding and where an intimate knowledge of the constitution of the milling material is necessary in order to obtain the highest efficiency from grinding and the best recovery in milling.

*Mining engineer, Doe Run Lead Co., Rivermines, Mo.

Description of the Ore

The ores of the lead belt of southeast Missouri are constituted of large deposits of galena disseminated in calcareous gangue. A complete analysis of a six months' composite sample made by me shows the following composition:

ANALYSIS OF A COMPOSITE SAMPLE

	Per Cent.		Per Cent.	
P	4.78	P	0.017	
Cu	0.021	Cl	trace	
Zn	0.97	CaO	29.21	
Fe	4.45	MgO	11.25	
Mn	0.45	Al_2O_3	5.01	
Ni and Co	0.020	SiO_2	6.15	
Bi	trace	CO_2	34.48	calculated
S (total)	3.03			
As	none	Total	100.018	

Galena is distributed in the gangue in all sizes from lumps weighing several pounds to microscopical dimensions. The predominating form is the cube and cleavage planes are seldom distributed along the faces. Pyrite and marcasite are more or less associated with galena, and the lead is entirely present as a sulphide, being deposited in the mass by an excess of reducing agent as proved by the total absence of anglesite. Small grains of pyromorphite are, however, sometimes identified under the microscope, but the amount of this mineral is very small as it can be deduced from the total phosphorus shown by the chemical analysis.

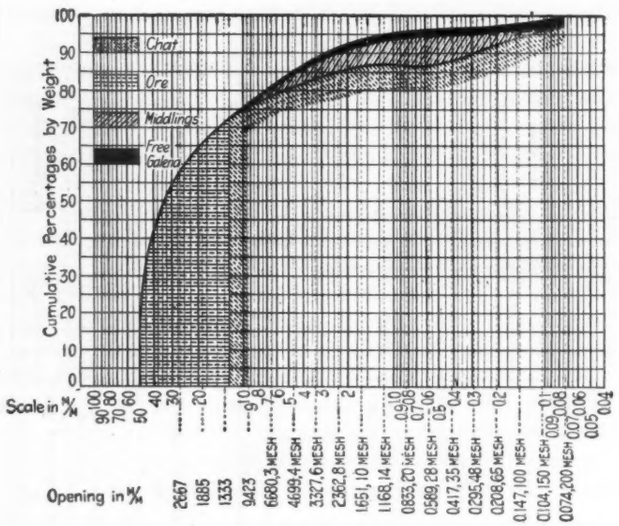


FIG. 1. SCREEN SORTING ANALYSIS

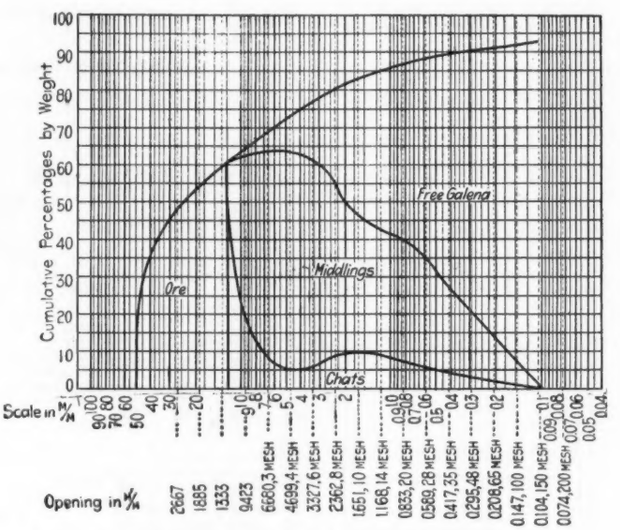


FIG. 2. PER CENT. OF TOTAL LEAD CONTENT

Details of Screening-Sorting Analysis

The diagram, Fig. 1, represents a cumulative logarithmic plot of a screen analysis of the ore as it leaves the gyratory crushers; that is, before any mill treatment or classification. The material collected on each screen was carefully sorted. On coarse material, up to 9 mm.,

sorting can be done by hand, but as there is no free galena up to that size—except an occasional piece that cannot be taken into account—and consequently there is not a clear separation between ore and middlings, the diagram was divided by a vertical line, calling "ore" whatever is coarser than 12 millimeter.

The sorted portions are weighed and assayed for lead only and weights rated to the percentage of weight found by the screen analysis. All elements are at hand for tracing the curves of separation between free mineral and middlings and between these and chat. While on coarse sizes sorting is rapidly performed by hand, on sizes finer than 9 mm. this is very laborious, especially when dealing with large samples weighing several kilograms, as is necessary when seeking mathematical deductions. I have therefore devised a method of sorting which, although calling for extreme care, affords the only accurate and reliable separation of the components of a screened material.

A solution of methylene iodide (CH_2I_2) is poured into a separatory or an ordinary funnel the stem of which

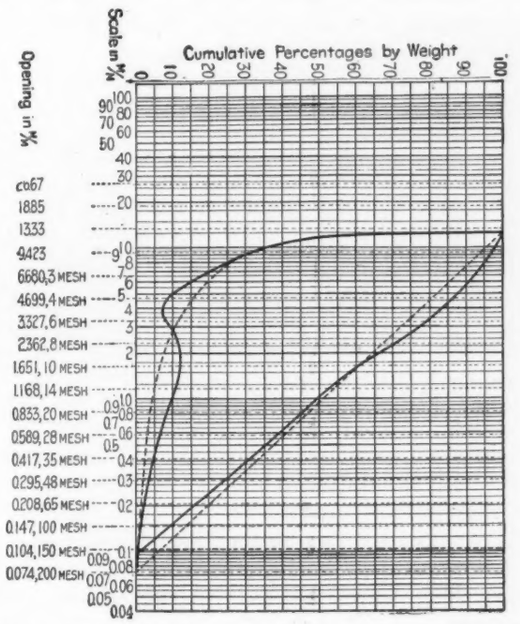


FIG. 3. PROPORTION OF TOTAL LEAD IN EACH SIZE

is closed by means of a piece of rubber tubing and a clamp. The material is slowly poured in the funnel and stirred with a thin glass rod. The chat immediately floats on the surface of the heavy liquid, while free galena and middlings collect in the stem of the funnel. The floating portion is collected, washed with water and the methylene iodide carefully recovered. A small hand centrifuge would prove convenient for this operation. What is left in the stem of the funnel—generally a few grams of minerals out of several hundred—is collected in a watch glass and sorted under alcohol over a black surface, of course, after removing the separating liquid.

Sonstadt solution (mercuro-potassic iodide) can be used instead of the methylene solution, but the necessity of keeping it hot prevents successful handling. With the one solution or the other, the chat is removed in very few minutes and the bulk of the material is reduced to a small amount on which sorting can be easily and completely done by hand even on sizes up to 65-mesh. On finer sizes sorting is evidently impossible, and the test is conducted as follows:

After separation from the chat the heavy portion is weighed and about a gram of it is collected in a parting porcelain crucible and incorporated with a pulp of dental enamel which rapidly solidifies. The mass is then carefully polished and the percentage of lead in the middlings determined by microscopical examination with the combined method of the count and surface measurement. Once the determination is made, the remaining portion is analyzed for copper, zinc, iron and lead. The weight of middlings and free galena is found by deducting from the weight of the portion obtained by separation the weight of the other metallic sulphides, and then an elementary system of equation will give the percentage of Pb in the middlings and free. Calculations may be so arranged:

Material: Mill feed. Size: Minus 80, plus 100.
Grade of Middlings: 22.0%. Weight of Head Sample: 20 grams.

Product after Separation:	Grams
Concentrates	5.975
Chat	13.998
Loss	0.027
Total	20.000

Analysis:			Grams
% Pb in head sample	18.78	Pb contents of same	3.758
% Pb in concentrates	61.17	Pb contents of conct	3.646
% Pb in chat		Pb contents of chat	0.112
% Fe in concentrates	5.17	Equal to FeS_2	0.670
% Zn in concentrates	3.08	Equal to ZnS	0.275
Total sulphides other than PbS			0.945

Composition:	Grams
Galena, middlings and other sulphides	5.975
Other sulphides as per above	0.945
Galena and middlings	5.030
Middlings plus galena equal	5.030
0.22 Middlings plus 0.87 galena equal	3.646

Distribution of Lead:	
Percentage of total Pb in chat	0.29
Percentage of total Pb in middlings	8.61
Percentage of total Pb free	91.10
Total	100.00

The diagram, Fig. 2, is obtained by combining the readings of diagram, Fig. 1, with the individual results of the analysis on each size. It shows how the lead is divided as a whole; and by a general examination of it it is obvious that (a) the amount of free galena is increasing with the reduction; (b) the amount of chat is also increasing with the reduction, but by an entirely different law; (c) the amount of middlings is increasing up to a certain size (28-mesh) and then decreasing again to zero.

The sag shown in the line of middlings in both diagrams, Figs. 1 and 2, is evidently due to the fact that these propositions are simultaneous.

Diagram, Fig. 2, has been transformed into diagram, Fig. 3, by referring the distribution of lead in each size to the total amount of Pb in that size. The total ordinate was therefore divided into three portions representing the percentage of total Pb existing on each size as pertaining to free galena, middlings and chat respectively.

It is important to note how near a straight line is the curve representing the variation of free galena. But more important is the fact that a straight line connecting the foot of the 12-mm. ordinate (no free lead) with the origin of the 200-mesh ordinate (all free lead) is a compensation line of the curve. Furthermore the hyperbola having the 12-mm. ordinate as an asymptote and the origin of the ordinates as the other asymptote (shown as tangents in the diagram for practical purposes) is

also a compensation line for the curve of chat. From the foregoing and for all practical purposes it may freely be assumed that the freeing of galena increases with the reduction and it is directly proportional to the natural logarithm of the size.

The law of distribution of lead in the southeast Missouri ores is obviously as follows:

$$Yl = Log\ S \times cot\ 48^\circ\ 30'$$
$$Yc = 250 \div log\ S$$
$$Ym = 100 - (Yl + Yc)$$

where S is the size in millimeters and Yl, Yc and Ym can be read directly from the diagram and represent the percentage of lead in galena, chat and middlings on that size respectively.

On and through 200-mesh no lead is combined with the gangue, as middlings, as is shown by a thorough microscopical examination of the dry slimes in glycerin immersion or mounted in glycerin. It is also proved by the possibility of making an 86.5% concentrate by the use of heavy solutions naturally accounting for the presence of iron, zinc and copper sulphides. The amount of Pb in chat is then 0.0001% as obtained by difference. The entire freeing of galena is due to the extreme fineness of the 200-mesh product which is approximately so constituted: On 300-mesh, 5.0%; on 500-mesh, 25.0%; on 1000-mesh, 30.0%; —1000-mesh, 40.0%. The first figure was obtained by direct screening and weighing, the next two by microscopical examination with the method of comparison and count and the last figure by difference. Between 200- and 300-mesh the only mineral combined with galena is blende entering these ores as a product of secondary formation and substitution. The reason is easily understood by an examination of the drawing showing the typical structure of lead-zinc middlings.

TYPICAL ASPECT OF ZINC-LEAD MIDDLING

Gardening by Mining Employees

Secretary Lane, of the Department of the Interior, has become much interested in the subject of increase of food supply, and recently sent the following letter to all mining companies in the United States through the Bureau of Mines:

"It has come to my attention that certain of the mining companies throughout the United States have officially taken up for their employees, the wives of employees, and children, plans for the growing of vegetables in the yards of the workers and even on vacant land owned by the companies. Some of the companies have even gone to the extent of supplying, either free or at cost, fertilizer and seeds, and also made provision for the plowing of the ground at actual cost. In other instances the companies have offered prizes for the best gardens of $25 for the first; $15 for the second; $10 for the third, and a number of minor prizes, with the result that a great amount of patriotic enthusiasm has been aroused.

"I have been so impressed with the starting of such a movement, modest as it is at the present, that I feel it to be my patriotic duty to urge upon all mining companies, where the conditions are favorable, to start some similar plan that would in the end result in a vast increase in the amount of food products raised during this time of national emergency.

"War today is as much a matter of food supplies as actual fighting in the trenches. The man or woman or child who raises enough vegetables this summer in his garden to feed the family places at the disposal of the men at the front fighting for a world democracy just that much food.

"The growing of these vegetables has also the additional virtue of giving healthful outdoor exercise to the people and for their consumption vegetables which are fresh. Back of all this you are helping to maintain the soldiers and the less fortunate populations of the world that have been thrown out of their natural orderly life by the encroachment of the war upon their properties.

"The Department of Agriculture is enthusiastically in favor of this movement and has prepared for the use of those interested Farmers' Bulletin 255, The Home Vegetable Garden, which will be sent to anyone who makes application. This pamphlet has already proved of valuable assistance to those engaged in making a garden. I take pleasure in sending to you under separate cover a copy of the pamphlet, so that you may see its value in this work.

"It is suggested that those who join this garden movement shall place in their garden an American flag as a reminder that he who serves his country in this capacity serves the flag."

Consolidated Interstate-Callahan Mining Co.

The report of the Consolidated Interstate-Callahan Mining Co., Wallace, Idaho, for the first quarter of 1917. shows that 37,700 tons of ore was mined and 30,979 tons milled. The average ore content was 23.7% Zn, 6.7% Pb and 2.5 oz. Ag. A total of 15,473 tons of concentrates was shipped containing 13,260,046 lb. of zinc and 1,479,032 lb. of lead. The total mill recovery was 78.25%, and the recovery on the basis of metals paid for was 74.20%. The total amount of zinc in ore and concentrates shipped was 12,614,475 lb., and of lead, 1,479,032 pounds.

The cost of mining per ton mined was $4.503, and the cost of milling, per ton of ore milled, was $1.567. The profit for the quarter was $377,575, from which the cost of improvements, $33,418, is to be deducted. One dividend of $1 per share, amounting to $464,990, was declared, bringing the total dividend disbursement since Apr. 1, 1915, up to $12.50 per share, or $5,812,375.

North Butte Mining Co.

The report of the North Butte Mining Co. for the first quarter of 1917 shows that during the period 175,640 wet tons of ore and 13 wet tons of precipitates were shipped and 171,290 dry tons of ore and 9½ dry tons of precipitates were treated. This produced 8,140,361 lb. of copper, 382,286 oz. of silver and 564.085 oz. of gold.

During January and February 2737 wet tons of zinc ore was mined and 2695 dry tons treated, producing 546,219 lb. of zinc and 4,481.18 oz. of silver.

"Caliche" Deposits of Atacama Desert, Chile

By Fred MacCoy*

SYNOPSIS—Some of the nitrate minerals and conditions under which they are found in the Atacama Desert. A number of the soluble salts of sodium and potassium occur in commercially important quantities in this arid desert in northern Chile.

Owing to the low humidity constantly prevailing in the Atacama Desert of Northern Chile, commercial quantities of many minerals, some of which are soluble in water, are found in the *Caliche*. Among these are the following: Niter (KNO_3), perchlorate of potash ($KClO_4$), soda niter ($NaNO_3$), halite ($NaCl$), glauberite ($Na_2SO_4CaSO_4$), thenardite (Na_2SO_4), iodate of sodium ($NaIO_3$), lautarite (CaI_2O_6), dietzeite ($7Ca(IO_3)_2.8Ca CrO_4$), borax ($Na_2B_4O_7.10H_2O$), kröhnkite ($CuSO_4.Na_2SO_4 + H_2O$), chalcanthite ($CuSO_4 + 5H_2O$).

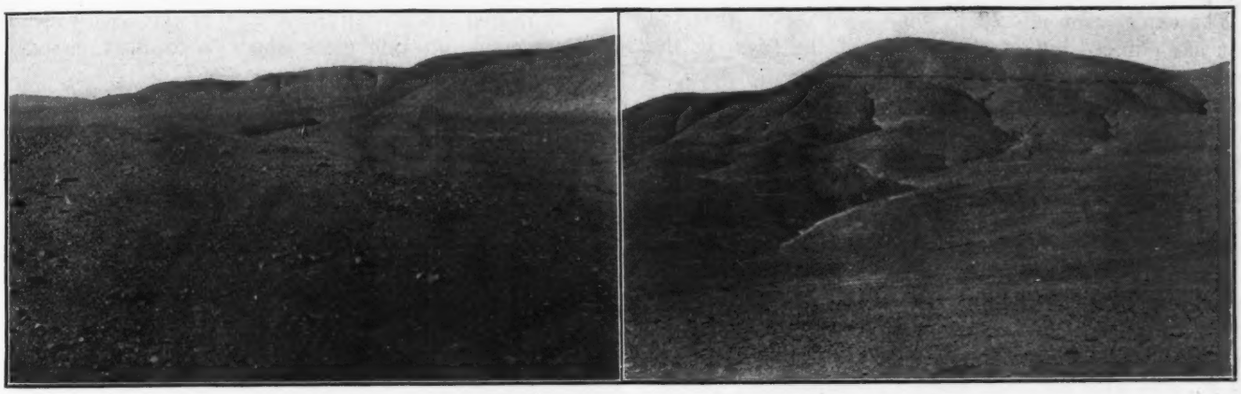
In addition, there occur in minor quantities: Copiapite ($2Fe_2O_3.5SO_3.18H_2O$), melanterite ($FeSO_4 + 7H_2O$), coquimbite ($Fe_2(SO_4)_3 + 9H_2O$), darapskite ($NaNo_3.Na_2SO_4 + H_2O$), nitro-glauberite ($6NaNO_3.2Na_2SO_4.3H_2O$), nitro-magnesite ($Mg(NO_3)_2 + 6H_2O$).

Other minerals not soluble in water, but occurring in commercial quantities: Atacamite ($Cu_2ClH_3O_3$), brochantite ($CuSO_4.3Cu(OH)_2$), ulexite ($NaCaB_5O_9.H_2O$).

These usually occur in mixtures of several minerals, and rarely in a separate state. An analysis of the *caliche* of the nitrate beds of the Antofagasta *pampa* shows

Nitrate of soda	29.130
Nitrate of potash	1.240
Perchl. of potash	0.005
Chlor. of soda	15.940
Sulph. of lime	3.530
Sulph. of magnesia	2.100
Sulph. of soda	10.800
Iodate of soda	0.105
Biborate of soda	0.430
Insoluble	34.380
Combined water	2.340
	100.000

It is not my purpose to discuss the origin, but rather to describe the occurrences of some of the more important deposits. Conditions for the accumulation of large deposits of such minerals are not known to obtain to such a degree in other locations as in the Atacama Desert. This point may well be illustrated by a consideration of two of the theories of the origin of the nitrate deposits—electric fixation, and the origin through bacteria working on organic matter converting the organic nitrogen into nitric acid. The tropical plains of the Amazon, on account of heavy electric storms and luxurious tropical growth and decay, afford a most propitious locality for both of these assumed processes, yet on account of heavy rainfalls this region is one of the impossible locations for accumulation of deposits of any soluble salts. Hence it is assumed that the existence in commercial quantities of deposits is due to the extreme dryness of the air and absence of rainfall. The relative humidity of the desert air, as observed in the Aguas Blancas Pampa over a period of several months, ranges from 8% to 50% with a daily average near 30%.



SCENES IN THE NITRATE FIELDS OF THE ATACAMA DESERT

A "Rio Seco" in a nitrate field, showing desolate country

Upper limit of nitrate beds, shown by dotted line

A nitrate *pampa* may well be said to be the dreariest spot on the face of the earth. The deserts of New Mexico, with their sky lines of sandstone escarpments and an occasional greasewood bush, look like the Garden of Eden when compared to a Chilean nitrate *pampa*. The ground is everywhere covered with a dust firmly crusted over by a cement of the contained salts. A dog can run over the crust, but the weight of a man breaks through. Once a horse has passed over the *pampa* and the wind has blown his tracks clear of dust, the trail remains for months—even years. In his "Voyage of the Beagle," Darwin states that the only evidence of plant life that he saw in this desert was a fungus growth on the body of a dead mule. As dead mules are not very abundantly distributed over the *pampa*, plant life is not very extensive.

The *pampa* is everywhere traversed by *rios secos*, or dry stream beds, in which ripple marks show as plainly in the sand as though made yesterday. In some parts of the plain the surface is sprinkled with fragments of rock radiating from a common center, as though some gigantic volcanic bomb had burst, throwing its fragments in all directions.

A great part of Central Pampa is covered with a sprinkling of nodular chalcedony in pieces about 3 in. wide. One *pampa* exhibits a considerable quantity of isolated rhombohedrons of calcite in the surface crust, while in other parts of the same *pampa* carbonates are entirely wanting. In one *pampa* covering 100 square

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miles of territory, the country rock may be rhyolite, phonolite, diorite or andesitic tuffs and clay, with no difference either in the appearance or value of the overlying *caliche*. As yet, investigations have failed to show any one class of rock as being favorable to the accumulation of nitrates, and one is led to believe that topography and not geological structure governs the deposition of the beds.

It would seem more probable that being soluble salts, the deposits would occur in the basin of the *salars*, or old lake beds, but such is seldom the case. The greater number of *calicheras* are on the gentler slopes and even on the tops of the mountains. It might be generally stated that when the slope becomes sufficiently abrupt to cause the *quebradas*, or dry rivulet beds, to take a direct line, there will be no nitrate; but when the slope decreases so that the *quebradas* take a winding course, conditions are more favorable for deposits of high-grade *caliche*. Carrying this idea farther, it was found on one *pampa* that when the ground became more level, say a 5-deg. slope, the beds became thicker but of lower grade, and that at about a 2-deg. slope the nitrate disappeared altogether.

The explanation offered by some observers is that the salt has climbed out of the bottom of the basin in the same way that nitrate will climb up the edge of a saucer from a concentrated solution. Even if this is so and one agrees that the nitrate has climbed up five miles of slope to a height of several hunderd feet, it does not explain the occurrence of deposits on hilltops a thousand feet above the *pampa* and separated therefrom by a barren zone of 30° or more of slope.

The nitrate bed is not necessarily a uniform plane, for in rolling country it follows very closely the warp of the surface and dips down beneath the smaller *quebradas*.

The *caliche* occurs at varying depths, from exposed to 50 ft., and with varying classes of overburden.

Two typical cases are:

DEPTH OF CALICHE BELOW SURFACE

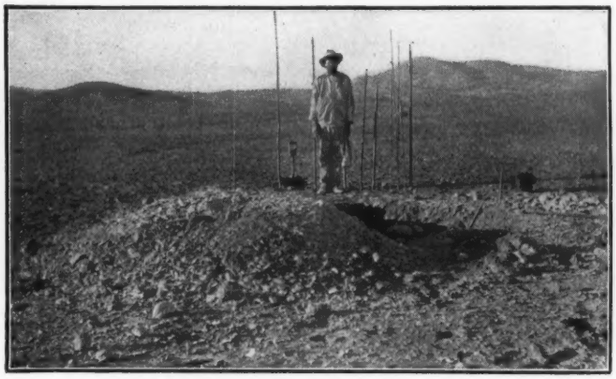
	A	B
Dust (chusca)	6 in.	6 in.
A partly cemented conglomerate (costra)	0 in.	24 in.
Caliche	24 in.	60 in.
Country rock	Underlying	.....
Dry clay (banco)	.....	Underlying

In some of the beds there may be an overlying bed of miribilite ($Na_2SO_4 + 10H_2O$), gypsum ($Ca_2SO_4 + 2H_2O$) and other sulphates, forming a porous mass called *panqueque*. Not much dependence can be placed upon surface indications, although in a majority of cases the surface shows numberless minute cracks, so that the ground has the color and appearance of a coffee-cake on which the sugar coating has just started to melt and run.

The *caliche* itself has an infinite range of colors and structure, ranging from white to black and from red to green, the varying colors depending upon associated minerals. The standard *caliche* most closely resembles a terra-cotta colored brick, with the same grain and hardness.

On account of the amount of sulphates contained, the rock will absorb moisture and disintegrates when taken down to the seacoast, but will remain for months in stockpiles on the *pampa*. Pieces that have been left in the desert air for several years disintegrate slowly, and an observer passing an old prospect pit can usually tell whether any *caliche* has been found by looking over the waste heap. The pieces take the shape of bonbons that have been stored in a warm room and have commenced to melt. Occasionally the nitrate occurs as a coating on brecciated country rock, and while not of a high grade, yields a high percentage in treatment. The usual method of production is to strip the overburden and break up the *caliche* with black powder. The powder is made on the *pampa* by mixing finely ground coal with dirty nitrate from cleanups and native sulphur from deposits near the Bolivian boundary. It is not very efficient, but is inexpensive.

The principal borax mineral is ulexite, although tincalconite occurs in some localities. The ulexite in the larger deposits is usually mixed with sulphates and occurs in stratified beds alternately with salt and earth. At the Salar de Punta Negra the soil around the margin of the lake is largely mixed with ulexite; yet in the lake common salt is practically the sole saline constituent. Ulexite occurs in the nitrate *pampa* in the form of small balls in the *chusca* and in pockets in the form of powder. It also occurs on the top of hills at an elevation of 1000 ft. above the nitrate *pampa*. Dana states that it is locally called *"tiza."* This word is applied indifferently in Chile to almost anything that will make a white mark, such as chalk or kaolin. In the *borateras* the clay and borax form cemented crusts over the surface of the beds, which, in time crack up into slabs about 3 to 5 ft. across.



A TEST PIT IN THE NITRATE BEDS OF ATACAMA DESERT

These slabs curl up and dry out and will support the weight of a horse. A ride across such a surface is not the most pleasant thing imaginable.

The principal commercial deposits of kröhnkite and chalcanthite is at Calama. The Chile Exploration Co.'s mine at Chuquicamata is by far the largest mine in the district. At this mine these salts occur in the overburden and upper part of the deposits and are mined and treated with brochantite, which is the principal mineral. Kröhnkite occurs occasionally in the underground workings of the vein mines as an incrustation on the face of the rock and in the form of long hair-like crystals. The iodine minerals occur in the *Caliche* and are a byproduct. Here again, the natural minerals of the country are made use of in the production. Nitrate and coal are burned to form *carbonato*, native sulphur is distilled, the vapors passed through a solution of carbonate of soda and the resulting solution added to the mother liquor from the nitrate tanks precipitates the iodine.

Mineral Resources of Honduras are undeveloped, according to "Commerce Reports," Washington, D. C., but there are possibilities. There is hardly a stream that will not wash a little gold, but no paying and productive mines have been opened. Shipments of antimony ore of great purity have been made from the Yoro and Lake Yojoa sections of the Puerto Cortes district.

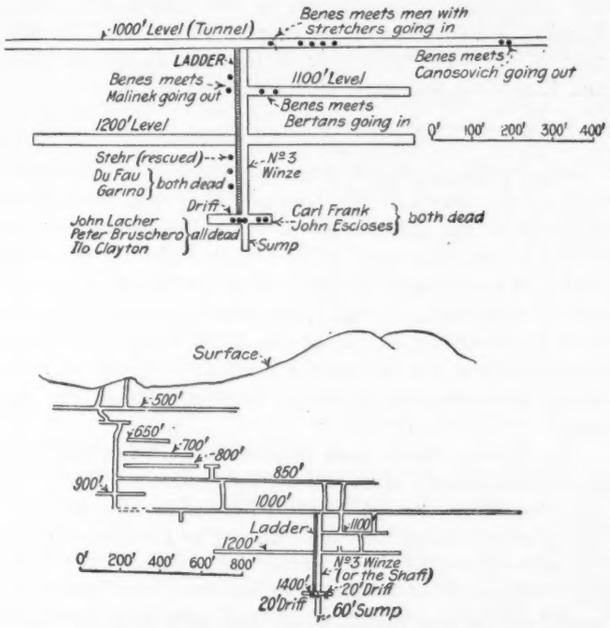
Disregard of Danger the Cause of Mountain King Fatalities

By Lewis H. Eddy*

SYNOPSIS—Seven men lost their lives in the Mountain King mine, in California, and a coroner's jury decided that the evidence had shown that they did not recognize, or act upon such recognition, the danger of going into freshly blasted workings.

The death of seven men from powder gas in the Mountain King mine at Mountain King, Mariposa County, Calif., Apr. 28, 1917, was evidently due, according to evidence adduced before the coroner's jury, to the fact that the men who first went into the mine disregarded or did not realize the danger of going into freshly blasted ground at the lowest level of the mine while the air compressor was shut down. Probably they were deluded by the false belief, prevalent among many miners, that the candle or carbide flame is a gage of safety. So, while their lamps continued to burn, they were unaware of the possible danger; or they may have been immediately overcome.

No direct evidence was given as to the exact number of men in the crew permitted to enter the 1400-ft. winze



LOCATION OF FATALITIES AT MOUNTAIN KING MINE

level where the trouble occurred; probably there were four or five. The dead are Peter DuFau, foreman; Joe Garino, John Escloses, Carl Frank, John Lacher, Peter Bruscher and Ilo Cayton. Two of these, DuFau and Garino, died in the effort to rescue the others. Peter Canosovich and Tony Malinck—whether of the original crew or among the rescuers does not appear—were very sick, but got out without help. Joe Stehr, who had gone down to aid DuFau, having been tied to the ladder, was rescued alive by Superintendent B. C. Austin. Frank Benes, who rendered first aid to the men, got out alive and alone. His extraordinary strength and physical endurance and frequent applications of ammonia saved his life. But he was unable to do more than temporarily resuscitate the others.

The accompanying illustration shows a section of the mine and from where the seven men were rescued from the winze ladder and the 1400 station after the air compressor was started. The 1000-ft. level is a tunnel and main working level, in which the electric motor and ore cars operate.[1] No. 3 winze is inclined 55°, extending from the 1000-ft. level to an inclined depth of 460 ft. below the 1000-ft. level with a station and level at a point 1400 ft. from the surface, and ending in a 60-ft. sump. This winze is commonly called "the shaft" by the miners. The winze connection, together with the raises from the 1200- to the 1100- and thence up to the 850-ft. level and the raise connection from the 900-ft. level to the air shaft extending from the 500-ft. level to the surface, furnished air in the 1100- and 1200-ft. levels, permitting some work to be done while the power was shut off.

Equipment of the Mine

The entire equipment of mine and mill is electrically operated; the current is generated by water power. A break in the flume furnishing the water, caused by the slipping of a stanchion, closed down the power plant on the night preceding the accident in the mine, so that during the shutdown of the power the hoist and the air compressor were both inoperative. The levels below 1000 ft. were then accessible only by ladder. When Mr. Austin learned at 6:30 a.m. that the power was off, he advised laying off the underground crew, but DuFau, the foreman, suggested track repairing in the 1200-ft. level, to which the superintendent agreed. Then DuFau sent some men to work on the flume and others to the 1200-ft. and the 1400-ft. levels. About 7 o'clock Mr. Austin went to the power house with the men to look after the flume repairs. At 8:30 he was advised by telephone of trouble at the mine and got the impression that three or four men were probably slightly knocked out by gas rising into the 1200-ft. level. He started for the mine and on the way learned that four or five men were overcome by gas on the 1400-ft. level.

After sending in calls for physicians, Superintendent Austin went to the mine and found men rigging up a hand-blower by belting a fan to a grindstone turned by crank, which was placed on the 1200-ft. level in the hope of driving air into the winze. With the assistance of other men he rigged up a light wooden skip, and the men lowered him on this skip into the winze to the 1200-ft. level. Hearing running water in the pump column, he got a hose connected and took one end down below the 1200 and sprinkled water where DuFau was tied to the ladder. Being affected by gas, Austin returned to

*Associate editor, 3430 Peralta St., Oakland, Calif.

[1] "Eng. and Min. Journ.," Apr. 21, 1917, p. 698.

the 1200, and after a bit he and one of the men went down again and succeeded in tying Stehr to the ladder. Stehr, the only survivor of the first eight men who went into the 1400-ft. level, was badly gassed and was unable to appear at the inquest. He had gone down to rescue DeFau, who was the man highest up the ladder. Then Austin was lowered down again, and he got Stehr into the improvised skip and finally got him up to the 1100-ft. line and on the timber truck.

Then the superintendent was lowered again, having a rope tied round his body as a measure of safety in case he should be knocked out, and tried to get the foreman on the skip, but could not make it. After going above and getting some fresh air into his lungs, he made still another attempt, but the air was so bad that he and Dondero, working with him, were obliged to get out and stay out of the winze below the 1200-ft. level. The four men relaying on the hand-blower had forced a little air below the 1200-ft. level through a 100-ft. hose, but only enough to keep the rescuers alive and enable them to save the life of Stehr. Austin said that it was impossible to save any more lives or to work longer in the 1400-ft. level until the compressor could be started. In the meantime outside help arrived, many of the volunteers having been advised of the accident by the San Francisco office of the Mountain King. The flume repairs were completed and the power turned on at 7 o'clock p.m., and the recovery of the bodies began immediately.

The Experience of Benes

The most important evidence, besides that of the superintendent, was by Frank Benes, who was sent to work with others on the 1200. He stated that DuFau had ordered some of the men to the flume repair and told others to go down and see how it was on the 1400, but not to stay if it was bad. Benes and others went into the 1200, the 1400 crew going ahead and talking of how lucky they were to escape work on the flume, as the weather was rainy. About 7:30 DuFau arrived on the 1200, sent the machineman and timberman to work in the face and Benes to clean the ditch. He then took a sample and started for the 1400. Benes said they felt all right on the 1200-ft. level. It was a little close and hot, but not bad. Presently he heard DuFau calling for help, saying some of the men on the 1400 were knocked out. He sent Benes for ammonia and to inform Mr. Austin of the trouble, and then took Garino and went down the winze. Benes went out and returned with two bottles of ammonia. He met Canosovich going out and very sick. He advised Benes not to go down, saying the men were all dead. Benes kept going. The station at the hoist was dark. He climbed down the winze and felt good, having sprinkled ammonia on his head and nose. He met Malinck coming up the ladder and "all in." Benes sprinkled Malinck with ammonia and told him to go up the hill. No evidence was adduced showing that Canasovich and Malinck had gone into the 1400-ft. level. Probably they had tried to go down and failed. They were too ill to testify.

"I went down the shaft," said Benes, "with my cap in my teeth and held the lamp in one hand and a bottle of ammonia in the other. There was no gas to speak of in the 1200. There was a bad place at the pump, 30 ft. below the 1200, hard to get over the first time, but the second time I had no trouble. I sprinkled DuFau with ammonia as I passed him; he was pale and foaming at the mouth. I passed Garino on the ladder and gave him a dose of ammonia and propped him up; he had no rope. My carbide was burning good. I got down to the 1400-ft. level. Ilo was close to the ladder. Gave him a dose of ammonia; also all the others who lay scattered over the station. All were bleeding at the nose and foaming at the mouth, but all were alive. I tore a jumper into strips, soaked them with ammonia and tied them about the men's noses. Then I began to feel bad and started to climb out, opening my second bottle of ammonia. Got up a distance of 10 ft. and could not drag myself up; thought I would rest on the 1400 and wait for the power; took a smell of ammonia and woke up; knew I must get up and climb. In a little while I knew nothing, but now remember reaching the 1100 level. Met Bertans going down; advised him not to go without preparation; the air was good on the 1100. Met Revaz and the blacksmith going down the ladder; told them to go back. I got to the 1000, the tunnel level, and felt better. Saw men with stretchers and told them to go back. I felt sick coming out of the tunnel. Then I washed up and got well again and got some ropes and water kegs and went in with Stewart and the timber truck. Got to the 1200-ft. level when they were getting Stehr up. Tried to work, but felt sick and did not go below the 1200 again."

Benes said that he spoke to the men, but they were unable to talk, responding only with groans. He and other witnesses said they had no time to look for tools or other evidence that the men had tried to do any work in the 1400 level. He thought he saw one carbide lamp burning, but could not remember certainly. Another witness said that the tools were all together except one pick, and that there was no evidence of work done.

Recovering the Bodies

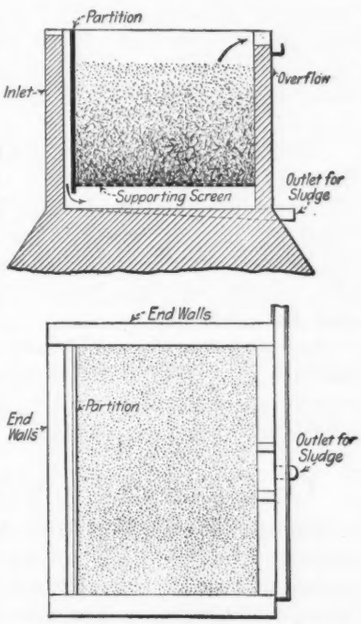
Other witnesses testified that DuFau's body was recovered about noon and the Garino's body was so situated and tied to the ladder that it was necessary to saw the ladder to get him out. They found Stehr on the 1100 level and took him to the station, where he was placed in care of a physician. One of the dead men had evidently tried to climb the ladder at the 1400, but fell and was squatted down, his face on the ground; two were on their backs; two others were far on the west side of the station.

Mr. Austin stated that outside help had arrived all the afternoon, and after getting the power, air was blown into the winze for 1½ hours with the compressor and they started taking the men out and to the timber shed. All below the 1200 level were dead. He did not know why the men went to the 1400, unless it was to see the results of the last round, which had been fired the night before. Two or more, he said, must have gone down and the others were lost trying to rescue them. He believed that no man could have gone 50 ft. below the 1200 level without knowing that there was gas and being affected by it. There was no reason, he stated, for the men to go below the 1200, as there was nothing to do on the 1400. They were all practical miners and most of them were the best on the mine; all but two or three of them had been at the Mountain King for a year or more and two for a month or longer. The evidence corroborates the investigation made by H. M. Wolflin and G. C. Brown, state mine inspectors.

The Clarification of Mill Water*

SYNOPSIS—The discussion deals with the technical control of ore slimes in the discarded water from the concentrating mills of Germany. It is particularly valuable for illustrating the application of principles earlier discussed[1]*, as well as giving the early history of German attempts to control the nuisance caused by muddy water from ore-dressing establishments. In this day of large flotation mills the slime load carried by discarded water is more and more liable to become quite large, and hence a cheap way of preventing the escape of these slimes should be given due publicity.*

At the beginning of the second half of the last century no effort was made to remove the slimes from mill effluents and they were allowed to run into the rivers. Not only were the streams rendered muddy, but the farmers below claimed that it damaged their land. In Germany the principal ore-dressing work was with lead and zinc ores. The amount of metal lost in slimes during the years since that time is almost inestimable



WATER-CLARIFYING BOX

The first clarifiers consisted of small shallow rectangular pits lined with wooden boards and only a few square meters in area. Then the wooden linings were displaced by masonry. As soon as it was found that a portion of the metals contained in the thickened slimes could be recovered, the size of the thickening ponds was immediately increased to as much as 100 sq.m. This was during the 90's. Toward the end of the century concrete construction was adopted and the size of the units was increased to 500 and 1000 sq.m. surface with a working depth of 1 to 1.5 m. These consisted of long, narrow reservoirs into one end of which the mill water flowed and from the other end clarified water was discharged. They were divided throughout their length by several concrete partitions, so that one compartment could be emptied without disturbing the others.

Since 1900 the clarifiers have been built, not as concrete-lined ditches in the earth, but of concrete construction resting on top of the ground, so that the settled material could be run out into cars or otherwise transported. The concrete walls are reinforced with old rails and other iron material. One trouble with these concrete flumes is that in winter the formation of ice often displaces or breaks the walls. The only protection is housing with a straw mat. This latter idea presented difficulty because of the dimensions the reservoirs were assuming, and the straw was in the way when they had to be cleaned out. Furthermore, the burden of snow and ice accumulating on the top was often too much for this type of construction.

In cold, mountainous sections the construction that proved best was somewhat as follows: The inner edge of the slimes pond was lined with pieces of U-shaped iron supports on which rested a straw cover about 2 m. wide. This cover prevented the freezing over of the edges of the pond while the ice in the center was solid enough to support the weight of the workmen.

More recently, clarifiers have been constructed to remove the slimes continuously, with their bottoms inclined toward the center, either from two sides or from all four sides, and the settled slimes withdrawn by a screw conveyor or by means of a suction dredge. These thickened slimes are not so dry as in plants using intermittent thickeners.

Filters for Clarification

While such settling arrangements were satisfactory on many slimes, there were others for which it was not satisfactory and for which nothing but filters were acceptable. These filters were constructed somewhat like sand filter-beds used in city water systems. One type was downflow and the other upflow. The downflow filters become clogged very quickly. The upflow filter-beds last longer, since much of the slimes settled into an open space below the filter support. The accompanying sketch gives a cross section of this type of filter. The filtering bed is made up of rock and sand, and the bottom is inclined so that it can be cleaned easily and the filtering bed renewed.

In order to get good work out of such a filter, it must be renewed comparatively often. Tests have shown that during the first week of use with poorly settling slimes, 50 to 64% of the turbidity was removed, and at the end of three weeks the clarification amounted to only 30%. In renewing these filters two men could take care of 100 sq.m. of surface per day of 10 hours.

Filter-dams were also used a great deal. A large area, either horizontal or gently sloping, was provided with the necessary dams of coarse material so that the pulp could stay in a relatively quiet place for some time before the clarified water percolated through the dam. Occasionally several dams in series were used. As the dam filled up it was raised, and it became common to keep the water surface two meters above the surface of the settled slimes in the pond. The great area of these ponds allowed the wind to stir up the slimes by wave action, and a number of devices were used to prevent it. Floating rafts of driftwood or of reeds were tried. Reeds soon sank and wood met the same fate within a year. A thin layer of oil was tried, but the wind would blow it to one side, and besides, it often ran through the dam.

*By G. Nicolai; abstracted and translated from the original German, as published in "Metal und Erz," 3: 135 and 155 (1915), by Oliver C. Ralston.

[1]"Eng. and Min. Jour.," 101: 763-9, 890-4, 990-4 (1916); "The Control of Ore Slimes," by Oliver C. Ralston.

Even after all these devices had been used, the upper Harz and Rhenish districts often discharged mill water carrying 3 kg. of solids per cu.m. Some of this water on standing in a beaker in the laboratory for a week still contained turbidity. This led Nicolai to test out chemical flocculation and sedimentation, the results of which are given in this paper. He tested a great many slimes with some of the materials which were cheaply available in Germany, such as cooking salt, kainite, streusalz, kieserite, karnalite, alum, etc., most of these being complex magnesium, potassium or aluminum salts from the Strassfurt salt deposits. Alum was the most efficient coagulant and next came the so-called "end liquors" from the Strassfurt potash works. This "end liquor" and "reject liquor" from the potash works consists mainly of magnesium chloride.

In the laboratory graduated cylinders were used for testing sedimentation of the slimes; the tables of results, however, are omitted from this abstract. Next a few barrels of "end liquor" were used in a test on a larger scale, the liquor being fed intermittently to the inflow of a clarifying pond. The result was to increase the sedimentation from 67% to 95% with a minute addition of magnesium chloride. Tests on a larger scale in larger ponds gave similar results. It was also noticed that during cold weather the sedimentation was not as efficient, as the floccules formed and sank more slowly.

Settling Costs in the Upper Harz

The following examples of cost apply to an Upper Harz mine. Nicolai has considered alum from Hanover, "reject liquor" from Vienenburg, solid magnesium chloride from Strassfurt—where they have to evaporate their final liquor—and sulphuric acid from Oker.

According to Nicolai's tests, 0.04 gram of alum is necessary for 1 liter of slimes containing 1.359 to 1.805 grams of solids per liter, or 40 grams alum per cubic meter. With alum at about 160 marks per metric ton ($34.60 per short ton) including freight and packing, the cost of clarifying is about 0.64 pfennig[2] per cubic meter, or 0.1455c. per ton.

The price of "reject liquor," sp.-gr. 1.3, at Vienenburg is 16 m. ($3.80) per ten tons; freight and tankage, about 38 m. ($9.04). Tests show that 4 c.c of a 1:10 dilution of this liquor is necessary per liter of turbid water. Reduced to the cost of 1 cu.m. of slimes, there are 0.41 c.c of undiluted liquor at a cost of 0.28c. or 0.636c. per short ton.

Solid $MgCl_2$ is redissolved on the ground to make a concentrated solution; 1 cu.m. of this liquor ready for use in the plant will cost, including freight and the cost of making the solution, about 11 m. ($2.62); 1c.c of this liquor is necessary for the clarification of 1 liter of slimes, so that the cost of clarification per cubic meter is 1.43 pfennig, 0.325c., per ton.

Crude H_2SO_4, 50° Bé. (1.53 sp.-gr.) costs at Okar 22 m. ($5.225) per ton; freight and tankage 4.3 m.; making the cost delivered, 26.3 m. ($5.69 per short ton).; 10 c.c. of 1:100 acid solution will clarify 1 liter of slimes, or 0.1 liter of undiluted acid per cubic meter of slimes, making cost 0.40 pfennig (0.091c. per ton of water).

For the mine in question the lowest cost was 0.0636c. per ton when using "reject liquor," although this cost might be lowered by making the proper contracts with the alkali works. A number of Upper Harz mines have been using the Vienenburg "reject liquor" for clarification of their slimes, and this magnesium chloride does not seem to produce excessive hardness of the water. For the few works in which it has been tested it was found that the clarified water contained from 2 to 11° "German hardness" while water is good for washing purposes up to 20° and for drinking purposes up to 30°.

It is found that these principles work well on a large scale, and in one works there is satisfactory clarification of a fairly slimy water by the addition of 0.4 liter of "reject liquor" per min. to a stream of 5 cu.m. per min., corresponding to a cost of 0.056 pfennig per cu.m. (0.0127c. per ton). On warm summer days the clarified water carries only 0.02 to 0.1 gram suspended solids per liter, while on cloudy or windy days it will be as much as 0.2 to 0.4 gram per liter, which is entirely satisfactory.

The clarifying liquor is added most conveniently in the launder leading to the settling or filtering apparatus, as it will thereby be well mixed with the slimes. The simplest installation consists of a tank of capacity sufficient to receive all the liquor from a tank car and provided with an outlet in the bottom. This is properly protected by the use of screens, etc., against clogging by solid particles, and a pipe or a launder leads to the slimes launder.

Another method of introduction of the clarifying agent into the slimes is to place a small waterwheel in the slimes launder and fix a series of small buckets on the shaft of the waterwheel in such a way that they dip up liquor from a reservoir and pour it into the launder. The number of little buckets can easily be changed to suit the conditions.

In conclusion, it would seem that purely mechanical methods of clarifying turbid water formerly used in Germany can be supplemented to advantage by the use of clarifying agents of a chemical character.

[2]One pfennig equals ¼c.

Corrosion of Tinned Sheet Copper

The Bureau of Standards, Washington, D. C., has recently investigated an unusual and interesting case of corrosion; namely, that of the roofing material of the Library of Congress. The roof of this building has been covered since about 1893 by tinned sheet copper which has become covered within the last 10 or 15 years with small pits; in many cases these pits have extended completely through the sheet.

Such a condition is interesting, particularly in view of the fact that Washington is uncommonly free from smoke, etc., which is ordinarily understood to be a strong accelerating factor in corrosion. The investigation has shown that the corrosion was due to no accidental inferiority of the material, but that it is to be considered as characteristic of all material of this type. It, therefore, appears that tinned copper is not superior in any way to tin plate, and that, in view of its greater cost, it can no longer compete with it.

Insoluble Iron in Ores—In a recent number of the "Chemist-Analyst," W. R. Roberts calls attention to the fact that many iron ores contain some of the iron as silicates, and advises invariably testing for this "insoluble iron." The easiest method is probably to filter off the acid insoluble and treat it with hydrofluoric and sulphuric acids in a platinum crucible.

The Mexican Constitution*

The new Mexican Constitution, signed at Queretaro de Arteaga on Jan. 31, 1917, and fully effective since May 1, contains 136 articles and 16 transitory articles, as against 128 articles and one transitory article in the Constitution of 1857. It is thus a document of considerable length, and an English translation published in parallel columns with that of 1857 by the American Academy of Political and Social Science, Philadelphia, makes a book of over 100 pages.

The new constitution suffers from the defect common to nearly all recent charters of its kind; all sorts of matters which were better left to legislation are crowded into the fundamental law. This sometimes results in absurdities as when the second paragraph of the thirty-third article declares:

> No foreigner shall meddle in any way whatsoever in the political affairs of the country.

A sumptuary warning! Just what is to constitute "meddling" the authors of this article did not attempt to say. And "political affairs" is a term rather hazily bounded. The President has the exclusive right to expel from the country forthwith and without judicial process any foreigner—against whom he has evidence of any kind? Against whom he could establish a prima facie case? No, any foreigner "whose presence he may deem inexpedient."

The Constitution of Queretaro is especially strict in regard to foreigners. Only Mexicans by birth or naturalization and Mexican companies have the right to acquire ownership in lands and waters, or to obtain concessions to develop mines, waters or mineral fuels. But we read:

> The nation may grant the same right to foreigners provided they agree before the Department of Foreign Affairs to be considered Mexicans in respect to such property, and accordingly not to invoke the protection of their Governments in respect to the same, under penalty, in case of breach, of forfeiture to the nation of property so acquired.

And within 100 kilometers from the frontiers and 50 kilometers from the seaboard no foreigner shall "under any conditions" acquire direct ownership of lands and waters.

This passage is preceded by a general assertion of national ownership of natural resources. It is followed immediately by a paragraph vesting in the national government ownership of all places of public worship, episcopal residences, rectories, seminaries, orphan asylums, convents or any other building erected for the purpose of furthering the tenets of any religious creed. The government has power to decide to what use such structures may be put; a place of public worship erected hereafter its national property; no charitable or educational institution may be administered by a religious sect or be under ecclesiastical patronage.

Monopolies are frowned upon except such as are reserved to the Federal government, which is to control absolutely the coinage, the postal, telegraph and wireless services, and the issuance of bills "by a single banking institution to be controlled by the Federal government." There is a further exception in favor of limited patents and copyrights. But note this highly modern clause:

> The law will accordingly severely punish and the authorities diligently prosecute any accumulating or cornering by one or more persons of necessaries for the purpose of bringing about a rise in price; any act or measure which shall stifle or endeavor to stifle free competition in any production, industry, trade or public service . . . and in general whatever constitutes an unfair and exclusive advantage in favor of one or more specified person or persons to the detriment of the public in general or for any special class of society.

Trade unions are legalized and so are coöperative associations for selling abroad, provided they act under government supervision and do not sell the necessaries of life.

Compulsory education is provided up to 15 years and compulsory military training is ordained for such periods as the various states may prescribe. Mexicans shall be preferred under equal circumstances to foreigners for all kinds of concessions and public employments. Just how far the compulsion extends it is hard to say, but at any rate "it shall be the duty of every Mexican citizen" to register not only for election purposes but for identification, to enlist in the national guard, to vote, to fill offices to which he is elected, to serve on the town council and to do jury duty.

The Queretaro charter goes in heavily for social and industrial welfare. First of all eight hours is the maximum limit of a day's work. The maximum limit for night work is seven hours. Unhealthful and dangerous occupations are forbidden to all women and to children under 16; these cannot do night work in factories nor work in commercial establishments after 10 p.m. Children between 12 and 16 may not work over six hours a day; the work of children under 12 cannot be made the subject of a contract. To every worker is guaranteed one day's rest in seven.

The provision safeguarding child-birth is broadly worded:

> Women shall not perform any physical work requiring considerable physical effort during the three months immediately preceding parturition; during the month following parturition they shall necessarily enjoy a period of rest and shall receive their salaries or wages in full and retain their employment and the rights they may have acquired under their contracts. During the period of lactation they shall enjoy two extraordinary daily periods of rest of one-half hour each, in order to nurse their children.

Employers must pay a minimum wage sufficient "to satisfy the normal needs of the life of the workman, his education and his lawful pleasures, considering him as the head of a family. In all agricultural, commercial, manufacturing or mining enterprises the workman shall have the right to participate in the profits." Minimum wages and the rate of profit sharing are to be determined by special commissions appointed in each municipality and subordinate to a state (not a Federal) board. For the same work women must receive the same pay as men. Minimum wages are exempt from attachment, setoff or discount.

And double pay is decreed for all overtime.

Overtime cannot exceed three hours nor continue for more than three days; no women and no boys under 16 may engage in it.

There seems to be no end to the wonders of the labor clauses of the new Mexican Constitution. Employers in every agricultural, industrial, mining "or other class of work" are bound to furnish to their workman sanitary and comfortable homes at a rental not to exceed 0.5% a month of the assessed value. They "shall likewise establish schools, dispensaries and other services necessary to the community." In addition to this private munificence every labor center having 200 or more inhabitants must also have a space of 5000 square meters for public

*From the New York "Sun."

markets, municipal buildings and places of amusement. Saloons and gambling houses are barred from this zone.

Strikes are unlawful only when the majority of the strikers resort to violence. Lockouts are lawful only when the excess of production shall render it necessary to shut down "in order to maintain prices reasonably above the cost of production, subject to the approval of the Board of Conciliation and Arbitration." This board will settle strikes. If the worker rejects its award the labor contract is terminated; if the employer refuses to submit his dispute or to accept the award, not only is the contract terminated, but the employer must pay the worker three months wages, in addition to any civil liability he may have incurred.

There are many other peculiar provisions, the presentation of which would possibly weary the reader. A bare mention may be made of the strange rules for what may be called the governmental administration of public worship. A church cannot be dedicated without the sanction of the Department of the Interior. Ministers are simply professional men. But freedom of religious belief is protected. The Congress may neither establish nor forbid any creed.

Can this new Mexican Constitution be made to work? It would seem doubtful if some of its provisions can be enforced. It is also extremely likely that a good number of them will be found incompatible with the rapid growth and development of the country. But the temper of the Queretaro charter is unmistakable. It has distrust of ecclesiasticism and of foreigners written all over it. All education must be secular; no man must be overworked or underpaid; Mexico is for the Mexicans. These are the underlying ideas expressed in cumbersome form. It will be interesting to see how they are put into practice.

Food Waste Among Miners

The mine boarding house, as an eating place for a large number of men and therefore of economic importance in the food question confronting the nation, is deserving of serious consideration. In an appeal to mining men to do their share to help relieve the possible shortage of food which may arise because of the exigencies of war, G. E. Collins, a Denver mining engineer, has caused to be sent to the person in charge of each of the mine boarding houses of his company a communication regarding the wastage of food.

The President has called attention, he says, to an impending shortage of food products in this country and has urged on all good citizens the imperative duty of increasing production from farm lands to the utmost possible extent, and on the other hand, of conserving what we already have by exercising economy and avoiding every form of waste. Wastefulness has always been the besetting sin of our nation; today it is a menace to our national existence. We cannot help in the direction of growing anything, but we can do much by lessening waste.

The following suggestions are made to further the campaign for economy: Absolutely no meat from immature animals (lamb and veal) should be purchased; fresh vegetables and fruits, when obtainable at reasonable prices, should be used instead of canned goods, which will be required for the armies; corn bread should be largely used; well-cooked oatmeal and corn meal should largely take the place of the expensive "package cereals"; until the new crop of potatoes is harvested, rice should replace potatoes as far as possible.

Report of Copper Production

This table is compiled from reports received from the respective companies (except in the cases noted by asterisk as estimated), together with the reports of the United States Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

	February	March	April	May
Alaska shipments	15,013,539	10,959,696	10,585,518	.....
Arizona:				
Arizona Copper	4,600,000	5,000,000	5,000,000	.....
Cons. Ariz. Smelting	‡	1,750,000	1,650,000	1,650,000
Inspiration	10,250,000	11,100,000	11,400,000	11,900,000
Miami	4,307,000	5,338,000	5,364,000	5,112,000
Old Dominion	2,695,000	3,335,000	3,516,000	4,430,000
Ray	7,177,898	8,006,843	7,902,724	.....
Shannon	888,000	950,000	924,000	964,000
Other Arizona	35,174,605	30,394,138	26,995,962	.....
California:				
Mammoth	2,200,000	2,000,000	1,850,000	2,000,000
Michigan:				
Calumet & Hecla	13,162,007	14,949,919	14,347,181	.....
Other Lake Superior*	9,000,000	9,500,000	9,000,000	.....
Montana:				
Anaconda	25,000,000	31,300,000	29,300,000	28,400,000
East Butte	1,460,440	1,597,340	2,081,080	2,008,060
Nevada:				
Mason Valley	†	1,821,695	1,300,000	.....
Nevada Cons.	5,708,214	6,864,675	6,727,192	.....
New Mexico:				
Chino	6,572,106	6,200,851	6,368,874	.....
Utah:				
Utah Copper	13,459,829	15,512,676	17,231,512	.....
Eastern smelters*	2,039,390	2,762,825	2,386,855	.....
Total reported	158,709,588	167,593,648	163,930,898	.....
Others, estimated	25,150,000	24,618,000	24,755,000	.....
Total United States	183,859,588	192,211,648	188,685,898	.....
Imports, ore and concentrates	13,782,019	10,951,006	.....	.....
Imports in blister, etc	24,348,811	32,039,119	.....	.....
Grand total	221,990,418	235,201,773	.....	.....
British Columbia:				
B. C. Copper	314,274	406,072	.....	.....
Granby Cons.	2,580,288	3,901,398	3,775,140	.....
Mexico:				
Boleo	1,598,240	1,984,080	1,653,680	.....
Cananea	5,100,000	5,500,000	4,730,000	4,370,000
Other Foreign:				
Braden	3,450,000	5,942,000	5,102,000	6,750,000
Cerro de Pasco	5,352,000	6,074,000	5,936,000	4,670,000
Chile	6,056,000	8,714,000	8,028,000	8,250,000
Cape Copper	329,280	387,520	353,920	.....
Kyshtim	1,178,240	985,600	.....	.....
Katanga	130,100	5,996,510	5,070,580	5,643,775

* Estimated. † Operation started in February. ‡ Included in "Other Arizona."

The grand total, which in the case of February was 221,990,418 lb., includes, under "Imports in ore and blister copper" the production of such companies as British Columbia, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the figures of the latter are given after the total. We also report the production of the Boleo, Cape Copper, Kyshtim and Katanga companies, whose copper does not come to the United States.

The item "Alaska shipments" gives the official figures of the United States Department of Commerce and includes Kennecott, which is not reported separately in the table. Kennecott production in February was 7,090,000 lb., in March, 7,076,000 lb., in April, 7,180,000 lb., and in May, 6,750,000.

The Phenomenal Increase in Vanadium Production is shown by the following figures from "American Vanadium Facts": Vanadium steel in 1913 to the extent of 90,000 tons was produced; in 1915 the production was 450,000 tons, while in 1916 it was 800,000 tons.

The Assayer and Chemist

Separation of Lithium from Sodium and Potassium

Samuel Palkin proposes a modification of Rammelsberg's old method for lithium determination which consisted in treating the dry chlorides with a mixture of anhydrous alcohol and ether in order to dissolve the lithium chloride (*Journ.* Am. Chem. Soc., p. 2326, 1916). This method is known to be unsatisfactory, both on account of the tendency of lithium chloride to be partly converted into the insoluble carbonate when dried in the air and on account of the occlusion of some of the lithium chloride by the insoluble chlorides of sodium and potassium.

The total alkali chlorides are dissolved in a minimum of water (1.5 c.c suffices for 0.5 gram of the mixed chlorides), one drop of concentrated hydrochloric acid added and then gradually 20 c.c of absolute alcohol. Then 60 c.c of ether is added gradually while stirring and the mixture allowed to settle. KCl and NaCl should be precipitated in granular form.

The mixture is filtered through a weighed Gooch crucible, washed with a mixture of 1 part alcohol to 4 or 5 parts of ether and the filtrate evaporated on a steam bath. The residue from the evaporation is taken up in absolute alcohol, a drop of hydrochloric acid added with about 50 c.c. of ether-alcohol mixture (4:1) and the mixture filtered through the same filter. The solution is evaporated to dryness on a steam bath, taken up with a little water, a slight excess of sulphuric acid added and the solution evaporated and the residue ignited and weighed as Li_2SO_4.

Determining Fluorine in Soluble Fluorides

A method for the determination of fluorine in soluble fluorides is proposed by J. G. Dinwiddie (*Am. Journ. Sci.*, December, 1916), which is based on the treament of the solution with powdered calcium sulphate. The resultant mixture of fluoride and sulphate is weighed and treated with sulphuric acid, thus converting everything to sulphate. The fluoride is then determined by noting the change in weight.

As the precipitate has to be treated with acid, it cannot be filtered on asbestos, because the hydrofluoric acid set free will attack the filter. Ordinary filters cannot be used, for if they are, during ignition the paper reduces some of the calcium sulphate to calcium sulphide.

The solution of the fluoride, which should occupy as small a volume as practicable, say 30 or 40 c.c., and should be neutral, is heated to boiling and powdered calcium sulphate added. After standing 30 min. to an hour, with frequent stirring, the precipitate is washed by decantation several times and is then put onto a filter made of a small disk of ashless filter paper cut so as just to fit the bottom of a perforated platinum crucible without its being bent up around the edges. This arrangement makes for convenience.

By keeping gentle suction upon the crucible the disk is held in place and the filtrate comes through without turbidity. As soon as the precipitate has been sufficiently washed, it is transferred with the aid of a fine jet of water to an ordinary platinum crucible. The disk of paper is washed free of precipitate and is ignited on the lid of the crucible. The acid is added to the contents of the crucible, which is evaporated to dryness on the steam bath.

If this residue is heated to redness to constant weight, it melts and becomes difficult to decompose with sulphuric acid. By experiment it was found that at a temperature around 300° C. the calcium sulphate loses all its crystal water and a constant weight is obtained. The proper temperature is obtained by heating the platinum crucible within an ordinary iron crucible, of diameter about 3 in. at the top, used as a radiator. In order to equalize the heat, a thin piece of asbestos was placed in the bottom and upon this was a small triangle for the platinum crucible to rest on. By heating the bottom of the iron crucible with a bunsen burner to a low red, the contents of the platinum crucible reach a constant weight in one hour or less.

When a constant weight has thus been obtained, the residue is mixed with a little water and several cubic centimeters of pure sulphuric acid. This mixture is now evaporated on the steam bath as far as possible and then, by heating further, the sulphuric acid is driven off, the last traces requiring the application of a red heat for a few moments. There is great danger of spattering when the excess of acid is being driven off. In order to avoid this and to permit the acid to be driven off quickly, the following method was adopted: The lid is placed on the crucible, which is resting on a triangle. A Meker burner is fastened above and slightly to one side of the crucible by means of an adjustable clamp. The flame of the burner is allowed to impinge from above at an angle of about 45° on the farther side of the lid of the crucible. In this way the heat can easily be regulated so that the sulphuric acid volatilizes rapidly, and since the heat radiates from above, there is almost no tendency to spatter. The residue obtained by igniting at 300° consists of a mixture of calcium fluoride and sulphate, while the residue remaining after volatilization of the sulphuric acid consists entirely of calcium sulphate. The increase in weight of the contents of the crucible is due to the replacement of two atoms of fluorine by the sulphuric acid radical.

Thus 84 of sodium fluoride gives 78.0 of calcium fluoride and 136.07 of calcium sulphate. Therefore 58.07 of increase corresponds to 84 of sodium fluoride and 78 of calcium fluoride, and to estimate the calcium fluoride present in the precipitate, multiply the increase in weight by $78 \div 58.07 = 1.3431$ and for the sodium fluoride multiply by $84 \div 58.07 = 1.4465$.

On account of the solubility of calcium fluoride, there will be a tendency for the results to run low, and unless the filtrate and washings are kept to a low volume, large negative errors are liable to occur. In several determinations the filtrate was about 200 c.c. and the results here were about 1.4% low. On account of this danger, a solution saturated with pure calcium fluoride and calcium sulphate was used for wash water in order to eliminate the solubility error and results very close to the calculated value were obtained even when the filtrate was allowed to get quite large. Under these conditions the error was less than 0.4% in seven cases out of eight.

Since, during the precipitation of the fluoride of calcium by the sulphate, an equivalent amount of sulphate ion is set free, it is obvious that this method is adapted without any modifications to the separation and determination of fluorides in the presence of sulphate. It may also be used for the separation of fluorine from other radicals which do not form insoluble compounds with calcium.

Correct Conditions for Aluminum Precipitation

An investigation of the proper conditions for the precipitation of aluminum as hydroxide has been made by the Bureau of Standards (Bull. 286). The conclusions are as follows: The precipitation of aluminum hydroxide by ammonium hydroxide is complete when the alkalinity of the solution is at the point at which methyl red and rosolic acid change color. Any excess of the base beyond this limit is to be avoided, as alumina dissolves even in ammonium hydroxide.

Making the solution strongly alkaline with ammonia and boiling off the excess is not good procedure, as the reagent dissolves lime, silica, etc., from the glass and thus contaminates the precipitate. The time-honored addition of ammonium chloride to the solution reduces the alkalinity and is thus of benefit. It also tends to coagulate the precipitate. The addition of glycerin or of tannic acid to the solution to make the precipitate granular is a mistake, as both reagents hold alumina in solution. The best results are obtained if there is about 5 grams of ammonium chloride to each 200 c.c. of solution after which ammonia is added to the nearly boiling solution until it is just alkaline to methyl red (or rosolic acid). The solution should then be boiled not over two minutes and filtered without waiting for the precipitate to subside. The addition of macerated filter paper is of advantage in filtering especially if there are large amounts of precipitate.

These conditions are also favorable for the precipitation of ferric iron and for the separation from calcium, strontium, barium and magnesium. The presence of ferric hydroxide makes no difference in the solubility of alumina in alkalies.

The precipitate should not be washed with hot water, but with ammonium nitrate or chloride solution. The former assists in the combustion of the filter paper. Contrary to widespread opinion, the use of ammonium chloride does not lead to volatilization of the precipitate during ignition. However, if the original solution contains chlorides and the mixture of filtrate and washings is to be evaporated in platinum, ammonium nitrate should not be used, as the platinum will be attacked. No free ammonia should be added to the wash water. Five to 10 minutes blasting of the precipitate is sufficient.

Freshly ignited alumina is strongly hygroscopic, and it will absorb in the first 10 min. of its exposure to moist air a large proportion of the water that it will absorb in 24 hours. Since the air in a recently opened desiccator does not differ greatly from that in an ordinary room, it follows that crucibles containing the ignited precipitates should be kept covered, both in the desiccator and on the balance.

The presence of fluorine greatly hinders or may entirely prevent the precipitation of alumina.

Commercial Copper Analysis

A variation in the usual methods of procedure for the analysis of copper is proposed by W. Graham Grant in the *Chemist Analyst*. His method of obtaining the iron precipitate that carries down the antimony, arsenic, selenium, tellurium, tin and phosphorus is as follows:

Weigh 10 grams of the drillings, transfer to a 1000-c.c flask and add 100 c.c. nitric acid of 1.20 specific gravity. When in solution, bring almost to neutral point with saturated sodium-carbonate solution. Dilute to 500 c.c. with nearly boiling water, and finish neutralization with carbonate solution. Into a small beaker put about 1.5 grams ferric chloride, dissolve this in water and neutralize with sodium carbonate; add the ferrochloride solution to the contents of the flask, and should any precipitate form, dissolve it with the least necessary amount of hydrochloric acid. Weigh out roughly 10 grams sodium acetate, dissolve and add to contents of the flask, bring to a boil, allow to settle, decant solution through filter, add about 500 c.c hot water to residue in flask, shake and again decant, and finally transfer precipitate to paper and wash well. The precipitate at this point should have the characteristic brown color of basic acetate of iron. Should the precipitate be contaminated with copper, owing to insufficient free acid or prolonged boiling, redissolve in the least possible quantity of hydrochloric acid and repeat neutralization, etc. The copper should now be eliminated. Redissolve the precipitate with hydrochloric acid into a 400-c.c. beaker, neutralize with ammonia, add about 20 c.c. ammonium sulphide, digest in a warm place for 30 min., filter and wash. Reject the precipitate of iron sulphide, acidify the filtrate with hydrochloric acid, allow to stand 30 min. and filter through a small filter. The precipitate contains the arsenic as As_2S_3, antimony as Sb_2S_3 and also contains any Sn, Se or Te present; and the filtrate contains the phosphorus as H_3PO_4.

French Laboratory Glassware

Laboratory glassware as now made in France has been found equal to the best German (Thuringen and Jena) ware in resisting the action of water (below, at and above 100° C.), hydrochloric acid, ammonia and $N/10$ solutions of ammonium chloride and sodium carbonate, according to a writer in *Comptes Rendu*, noted in the *Journal* of the Society of Chemical Industry, Nov. 30, 1916. Superior ability to withstand sudden cooling was observed only with Jena and with one make of Bohemian glass.

Company Reports

Phelps, Dodge & Co.

The annual report of Phelps, Dodge & Co., of New York, shows earnings for 1916 of $24,030,904, of which amount $2,056,642 was charged to depletion of ore and depreciation on plants, and $14,625,000 was paid in four regular and four extra dividends, amounting in all to $32.50 per share on the 450,000 shares issued. Current assets, consisting of merchandise, metals in process or on hand, accounts receivable, marketable securities, etc., totaled $16,735,612, with actual cash on hand, $7,746,519.

The metal produced from the ores of the constituent companies consisted of 152,263,729 lb. copper, 10,404,341 lb. lead, 1,642,055 oz. silver and 28,873 oz. gold. Ores purchased by the reduction works yielded 37,823,828 lb. copper, 588,327 oz. silver and 7,802 oz. gold. Including copper received from other sources, 247,303,587 lb. was sold and delivered to buyers at an average price of 24.48c. net cash f.o.b. New York, 176,468,527 lb. having been delivered to domestic and 70,835,060 lb. to foreign trade.

The mines of the company produced a total of 2,305,072 tons of copper ore during the year, an increase of 721,708 tons over 1915, Burro Mountain having contributed 245,148 tons of this amount. Of the total, 1,422,468 tons was concentrated and 882,604 tons smelted direct.

In addition, 28,904 tons of lead ore and concentrates, and 3245 tons of manganese ore and concentrates were produced from the Copper Queen and Bunker Hill mines.

There was smelted at the Douglas reduction works during the year 1,623,274 tons of raw ore and secondaries, the recovery being 94.21% of the copper content, against 93.5% for 1915. The blast furnaces treated 1,283,776 tons; 287,621 tons was roasted, producing 239,001 tons of calcines; 253,052 tons was treated in the reverberatories. The converters were charged with 288,496 tons of matte assaying 37.2% copper, and 38,300 tons of silicious ore, producing 86,607 tons of bullion.

The strike, which began at the Detroit Copper Mining Co. in September, 1915, was settled in January, 1916, and operations resumed. During the year 17,539,858 lb. copper was produced from 474,808 tons of ore—an average yield of 1.85% Cu from ores, which averaged 2.6% in copper content. A total of 470,583 tons of ore was mined, of an average grade of 2.582% Cu. Of this, 451,347 tons, averaging 2.387% Cu, was milled, producing 63,595 tons of concentrates averaging 12.074% Cu, a saving of 71.25%.. The smeltery treated 140,938 tons of total charge, with a recovery of 95.21%, producing a total of 8.770 tons bullion.

The net production of the Pilares mine of the Moctezuma Copper Co., as returned by the Copper Queen Reduction works, was 36,062,201 lb. Cu from 148,208 tons of material made up of concentrates, slimes, first-class ore and precipitates. Other properties of the Moctezuma company contributed 2009 tons of ore, which produced 803,186 lb. copper. The combined properties produced 1310 oz. gold and 471,867 oz. silver as well as 6162 lb. of molybdenum. The mill treated 715,070 tons of 3.273% copper ore, producing 143,939 tons of 12.782% concentrates, making a saving of 80.5%, with a ratio of concentration of 4.967: 1.

The net production of copper by the Burro Mountain Copper Co. was 6,980,855 lb., from 257,501 tons of ore of an average grade of 2.12%. Of this amount 245,148 tons was obtained from the mine and 12,353 tons from the ore dumps. There was milled 253,782 tons of ore producing 26,362 tons of concentrates averaging 13.937% Cu, a saving of 68.39%, ratio of concentration being 9.627: 1.

The low rates of concentration was constantly improved toward the end of the year, 77.16% being secured in November and 76.32% in December.

The Bunker Hill mines as Tombstone produced 59,299 tons of ore, classified as gold silver, silver manganese, manganese and wulfenite milling ores and siliceous, flux and lead smelting ores. The cyaniding department treated 20,426 tons and the concentrating department 16,487 tons, the latter producing a concentrate containing 70% to 85% manganese dioxide.

The Stag Canyon Fuel Co. at Dawson, N. M., produced 1,439,904 tons of coal, 618,725 tons of which was washed, making 500,048 tons which produced 300,571 tons of coke.

Gross sales of the Mercantile Department amounted to $8,406,635 and provided a net profit of 10.38%, an increase of 1.84% over 1915.

McKinley-Darragh-Savage Mines

The report of the McKinley-Darragh-Savage Mines of Cobalt, Ontario, shows the production for 1916 to have been 925,779 oz. silver, or 182,036 oz. less than the product of 1915. The price of silver for the year was 16.579c. higher than in 1915, while mining costs increased 12.030c. per oz., showing a net increase value of 4.559c. per oz. over the average price obtaining for 1915.

Ore reserves are estimated to contain 2,803,327 oz. With the present price of silver obtaining, a flotation process unit for the treatment of tailings, which for the year averaged 2.68 oz. ag per ton, is being contemplated.

The mill treated 62,676 tons of ore, making an 82.39% recovery from ores which averaged 14.797 oz.

Dividends to the amount of $269,723.04 were paid for the year, while a balance of $264,942.52 is carried in the treasury as a surplus.

Miami Copper Co.

The annual report of the Miami Copper Co. for 1916 shows a net profit of $7,984,133, from which dividends of $5.75 per share, amounting to $4,295,905 were paid to the holders of the 747,114 shares outstanding. The mine produced 1,842,017 tons of ore of an average of 2.07% Cu, from which 30.58 lb. copper per ton was recovered. A mill extraction of 73.88% was made. The total cost per pound of copper is stated in the treasurer's report as 9.523 cents.

Ore reserves were 16,400,000 tons, averaging 2.40% copper; 28,000,000 tons, averaging 1.06% copper, and 6,000,000 tons of partly developed mixed oxide and sulphide ore averaging about 2% copper. The mill treated an average of 5074 tons of ore per day with a maximum handled of 5600 tons. Alterations are being made which will increase the daily capacity to 6000 tons. The milling costs were: Direct crushing expense, $0.18839; direct concentrating expense, $0.22492; tailing and concentrate handling, $0.06671, water for concentrating, $0.08657; experimental expense, $0.02255; a total of $0.59914.

Old Dominion Co.

The annual report for 1916 of the Old Dominion Co., holding company for the Old Dominion Copper Mining and Smelting Co. and the United Globe Mines, shows the net income for the year to have been $3,532,125, derived from its stock holdings, consisting of 155,353 shares in the Old Dominion Copper Mining and Smelting Co. and 23,000 shares in the United Globe Mines. Dividends amounting to $12 per share were paid during the year, this being at the rate of 48% on the capital stock.

The ores mined by the Old Dominion Copper Mining and Smelting Co. during 1916 consisted of 98,761 tons smelting ore, averaging 7.03% Cu; 48,909 tons concentrating ore, averaging 3.72% Cu, and 4389 tons silica ore, averaging 3.89% Cu, making an average for all ores mined of 5.88%. During the year 254,213 tons of ore, 205,498 tons of which was custom ore, was milled, at a cost of $1.142 per ton, makihg a recovery of 86.63%. At the smeltery 271,367 tons of charge was treated at a cost of $2.793 per ton. Converting costs were $7.59 per ton.

The United Globe mines produced 15,378 tons smelting sulphide, averaging 7.16 Cu; 187,279 tons concentrating ore, averaging 3.28 Cu; and 3504 tons silica ore, assaying 5.45% Cu, a general average of 3.60%, the total of 206,163 tons having been shipped to the Old Dominion Copper Mining and Smelting Co.'s plant.

Quincy Mining Co.'s annual report for 1916 shows production of 21,065,612 lb. of refined copper, realizing, with silver contents, $5,400,874.51. Dividends paid from the year's income amount to $1,980,000, leaving a balance of $778,658.89 added to surplus. Wages have advanced 15% above normal during the period under review. In addition a bonus of 50c. per day was paid to each workman on Jan. 1, 1917.

Hecla Mining Co., of Washington, reports for the year 1916 receipts from ores, $2,543,072; from interest, $4000; miscellaneous, $2121; a total of $2,549,195, from which losses, expenditures and depreciation amounting to $1,850,388 were charged, leaving a net profit of $1,757,268. Dividends for the year amounted to $1,550,000. A total of 184,209 tons of ore was milled, and 16,461 tons was shipped in crude state. The costs per ton were: Mining, $2.346; milling, $0.506; ore transfer, $0.106; a total operating cost of $2.958. The gross value per ton was $10.174, leaving a net operating profit of $7.216 per ton.

Tough Oakes Gold Mines, Ltd. (no personal liability), of Kirkland Lake, Ontario, shows by its annual report for 1916 that the net profit for the year, with no allowance made for depreciation, was $260,668. Dividends were paid to the amount of $265,750 on the 531,500 shares of stock outstanding and the balance sheet shows a deficit of $104,567. A total of 37,594 tons of ore was sent from stopes, development and dumps to the mill, which treated 37,263 tons of ore and 2600 tons of stamp-mill tailings at a cost of $2.43 per ton. The metals recovered were 33,171 oz. fine gold and 13,051 oz. fine silver. The ore reserves are estimated to contain a round million dollars.

Centennial Copper Mining Co., of Michigan, according to the annual report for 1916, produced 2,367,400 lb. copper, which was sold at 25.02c. per lb., and received in interest and miscellaneous items $2545, making a total of $594,814. All operating charges amounted to $318,268. An assessment by the L. M. S. & R. Co. of $11,296, and a dividend of $90,000 were paid, decreasing the current assets of the company by $101,296 for the year's operations. Mining, milling, transportation and taxes amounted to $1.916 per ton on a total of 150,617 tons of rock produced, the average recovery of refined copper being 15.72 lb. per ton treated, at a total cost of 13.44c. per lb. There are 90,000 shares of stock outstanding.

Utah Consolidated Mining Co., of Utah, states that during 1916, 360,034 tons of copper ore and 74,542 tons of lead ore was mined, from which was recovered 12,211,118 lb. copper, 18,175,709 lb. lead, 558,845 oz. silver and 21,727 oz. gold. The profits for the year amounted to $1,924,176, from which dividends of $1,125,000 were paid on the capital stock of $1,500,000. Ore reserves at the end of 1916 were given as 180,000 tons copper ore averaging 1.77% Cu, 0.048 oz. Au, and 0.69 oz. Ag; also 23,400 tons lead ore averaging 16.03% Pb, 5.62 oz. Ag, 0.038 oz. Au and 0.81% copper. There is also two or three hundred thousand tons of low-grade copper ore that can be mined with a profit under present high prices, but is valueless under average copper prices.

Canada Copper Corporation, Ltd., purchaser of the properties and assets of the British Columbia Copper Co., Ltd., the former operating company, reports that during 1916, 306,450 tons of ore, of which 23,243 tons was custom ore, was smelted for a recovery of 5,196,239 lb. Cu, 49,928 oz. Ag and 12,366 oz. Au. The Mother Lode mine supplied 256,784 tons, averaging 0.945% Cu, 0.034 oz. Au and 0.160 oz. Ag. A profit of $215,304 resulted from the operations, which would be equivalent to $0.70 per ton for all material treated. Ore reserves, estimated to contain 10,000,000 tons of assured ore and 2,000,000 of probable ore, are given as containing 1.74% Cu and 20c. per ton in gold and silver values. Costs for the production of copper are estimated to be 9.57c. per pound.

Tharsis Sulphur and Copper Co.'s report for 1916 states that during the year there have been extracted from the Tharsis mines 14,211 tons of ore, as compared with 23,642 tons in 1915, a decrease of 9431 tons, says the London "Financial Times." In August last an extensive fall took place in the small Almagrera lode, which was the only lode being worked here, and extraction is stopped for the present. The uncovering of the Sierra Bullones lode has been actively continued during the year. The overburden removed amounted to 189,138 cu.m., as compared with 184,453 cu.m. in 1915. The overburden removed from Calañas mine during the year has amounted to 122,636 cu.m., as compared with 129,376 cu.m. in 1915, a decrease of 6740 cu.m. The ore extracted amounted to 389,197 tons, as compared with 377,508 tons in 1915, an increase of 11,689 tons. The refined copper produced has amounted to 3712 tons, as compared with 3970 tons in 1915, a decrease of 258 tons. The greater part of this decrease is due to the smaller quantity of copper now being produced at the mine; through the discontinuance of washing ore in situ, it being more profitable now, owing to the lower copper contents of the poorer mineral, to sell this outright in its crude state. The net profits for the year, together with the balance of $14,262 brought forward from 1915, as shown by the profit and loss account, amount to £213,412.

Round Mountain Mining Co., of Nevada, reports that during the period Apr. 1, 1915, to Dec. 31, 1916, the mines produced 67,452 tons of ore with a gross value of $409,409, from which $357,014 was recovered in milling at a total mining and milling cost of $341,552, leaving a net balance of $15,462, which was augmented by miscellaneous earnings, consisting chiefly of royalties paid by lessees, amounting to $6580, making a total net earning of $22,032. From Mar. 31, 1915, to Mar. 31, 1916, the average value of ores produced was $5.677 per ton, from which $4.935 was recovered in milling, or 86.9% of the total value. During the period Mar. 31, 1916, to Dec. 31, 1916, the average value of ores produced was $7104 per ton, from which $6236 was recovered in milling, or 87.7% of the total value. The bullion recovered from placer operations had a net value of $139,911, miscellaneous earnings amounted to $1555, operating costs were $74,098, leaving a net operating profit of $67,368. No dividends were declared. There were 1,320,630 shares of stock outstanding, 77,611 shares having been sold for treasury purposes during the period covered by the report.

The Tonopah Mining Co., of Nevada, in its annual report for 1916 shows that during the year 74,990 tons of ore with an average value of $15.67 per ton were mined and 5542 tons of dump ore with an average value of $15.06 per ton recovered, all of which were shipped to the mill, resulting in a gross value of material treated of $15.65 per ton. The costs of operations were: Mining and cost of handling dump ores, $4.61; milling, $3.16; freight on ore milled, $0.72; marketing mill products, $0.22; total, $8.71 per ton of product. Metal losses in milling and refining were $1.34 per ton, leaving a profit of $5.60 per ton. The average mill recovery was 94.2% of the gold and 90.9% of the silver values. Based on smelter returns, the recovery was 90.1%, or 0.2% less than that of the preceding year. Total direct costs show an increase of 15.7c. per ton, of which 9.2c. was due to the increase in price of cyanide, zinc and lead acetate, leaving but 6.5c. to be accounted for by the cost of other supplies and an increase in wages effective during the last two months of the year. Ore reserves were estimated to contain 72,100 tons, including ore in dumps, and as having an average value of $16.74, or a grand total of $1,206,821. The Tonopah Placers Co., a subsidiary, put three dredges into operation during the year, repaying $56,000 of their indebtedness to the company. Dividends at the rate of 75% were paid, amounting to $150,000 and the outstanding preferred stock, with interest, amounting to $380,557, was retired.

Wallaroo & Moonta Mining and Smelting Co., Ltd., of Australia, reports that during 1916 a profit of £231,504 was made, after allowing a charge of £14,540 for state income tax, £2809 for royalties on mineral leases and £747 for underestimation of Federal income tax for 1915. Two dividends, totaling £140,000, were paid. Among the interesting charges is one of £136,000 to taxation reserve account, invested as a provision against Federal and war-time profits taxation. The average price realized from copper was £113 3s. The Wallaroo mine produced 57,572 tons of ore which yielded 5111 tons Cu, an average of 8.88%. The Moonta mine produced 9935 tons of ore which yielded 1364 tons Cu, an average of 13.71%. The cementation plant at Moonta produced 878 tons of precipitate which yielded 648 tons Cu, an average of 73.72%. The smeltery treated 72,046 tons of cuperiferous material; from which was recovered 7653 tons Cu, 3027 oz. Au and 2884 oz. Ag. Of sulphuric acid 6930 tons was produced at a cost of £1 5s. 5d. per ton. The cost of production of copper was: Mining, including repairs and maintenance, £64 7s. 11d.; smelting, including repairs and maintenance, £13, 8s.; shipping charges and office expense, £2 11s. 1d.; a total of £80 7s. per ton, or approximately 6.8d. (13.6c.) per lb. of copper, no credit being allowed for gold and silver value, which amounted to approximately 0.36c. per lb. of copper. Copper to the amount of 300 tons per month has been contracted for 1917 to Kynoch, Ltd., Birmingham, and the rest of the product for the year, estimated at 300 tons, has been sold to the British Munitions Department and to the Indian mints and local Australian consumers at £116 13s. 4d. f.o.b. Sydney, N. S. W.

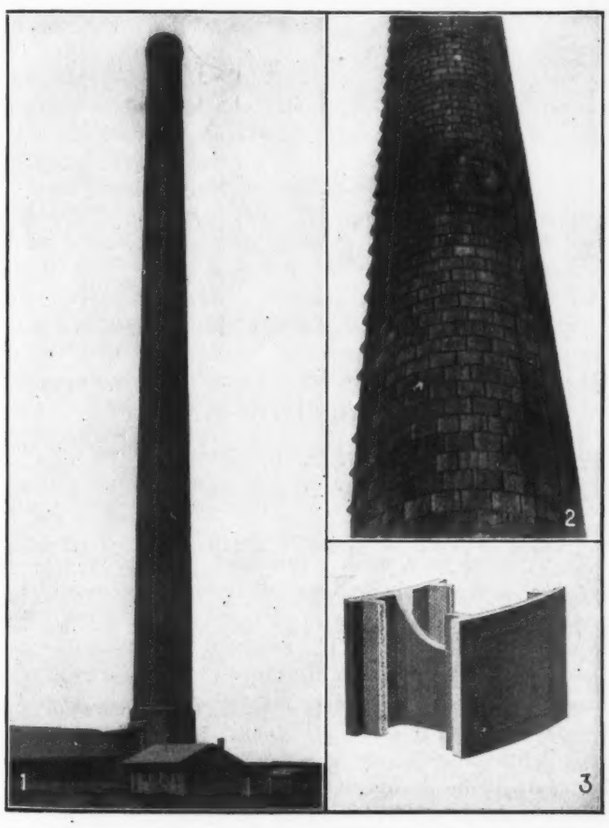
Details of Milling and Smelting

A 375-Ft. Smeltery Stack

By A. J. M. Proskauer*

There was recently completed at the Collinsville plant of the St. Louis Smelting and Refining Co., a reinforced tile-concrete chimney that is unusual in several respects. The principal dimensions of the stack are as follows: 375 ft. high above foundation, outside diameter at bottom 33 ft., outside diameter at top 17 ft. 4 in., inside diameter at top 16 ft.; foundation 45 ft. square, with a maximum thickness of 8 ft.; the wall is 12½ in. thick at the bottom of the round column and 8 in. thick at the top.

There were used in the construction of this chimney 2250 bbl. of cement, 657 tons of tile, 1500 cu.yd. of sand and gravel and 115,000 lb. of reinforcing steel. The



A 375-FT. SMELTERY STACK AT COLLINSVILLE, ILL.
In No. 1 is shown a general view of the completed stack; No. 2 is a closer view of the shaft and ladder; No. 3 is a part-sectional view of the Wiederholdt tile

weight of the chimney and foundation is 6,376,000 lb. In proportion to its size it is the lightest weight structure of its kind ever built. The pressure on soil at the toe of foundation, when wind is blowing at one hundred miles per hour, is a fraction more than three tons per square foot.

*Civil engineer, 620 National Bank of Commerce Building, St. Louis, Mo.

The chimney is built according to the Wiederholdt system of reinforced tile-concrete construction, wherein hard-burnt tile of special shape are used for forms and these are filled with concrete and reinforcing steel. By this means there is no occasion for moving forms and as a result a more perfect concrete construction is obtained. The face of the tile is 12 in. wide and 9 in. high. The

ERECTING THE REINFORCED TILE-CONCRETE STACK

tile gives the chimney the appearance of having been built of brick and is pleasing to the eye. In addition, the tile being absolutely acid proof, the interior of the chimney is not affected by the gases and the exterior suffers no deterioration from the action of the elements and condensation of gases.

The chimney is to be used in connection with a bag-house for carrying off gas that contains a small percentage of SO_2. The Wiederholdt Construction Co., of St. Louis, Mo., built the chimney.

Counter-Current Decantation at the Golden Leaf Mill

The annual report of the Bannock Gold Mining Co. gives interesting details of the results to be anticipated from the new counter-current decantation unit at the Golden Leaf Mill, Bannock, Mont., designed by G. W. Wood and expected to be in operation on Apr. 1.

The mill, of 150-ton capacity, was designed on the results of detailed experimental tests, the system adopted being the above-mentioned method with Dorr equipment. The plant has been arranged to be suitable for the operation of either one of two flow sheets, of 600 or 750 tons' capacity of solution precipitated, thus permitting effective operation with ore of different grades. The change can be made from one system to the other without shutting down the mill.

The tests showed a chemical consumption of cyanide amounting to 0.6 lb. and a mechanical loss of an equal amount, making a total of about 1¼ lb. per ton. The

time needed for effective setlement and cyanide protection has been estimated at 14 lb. per ton. On this basis the total cost for operating the mill has been forecast as $1.25 per ton of ore. The recoveries (extractions?) indicated from the peliminary tests were 97.4% of the gold and 67.8% of the silver or an ore ground to pass 150-mesh, the use of a 2-lb. cyanide solution and agitation for 24 hours. The high cyanide loss is noteworthy and doubtless arises from the use of a strength of solution somewhat out of proportion to the grade and apparent character of the ore. Operating results, especially with reference to precipitation costs, will be awaited with interest.

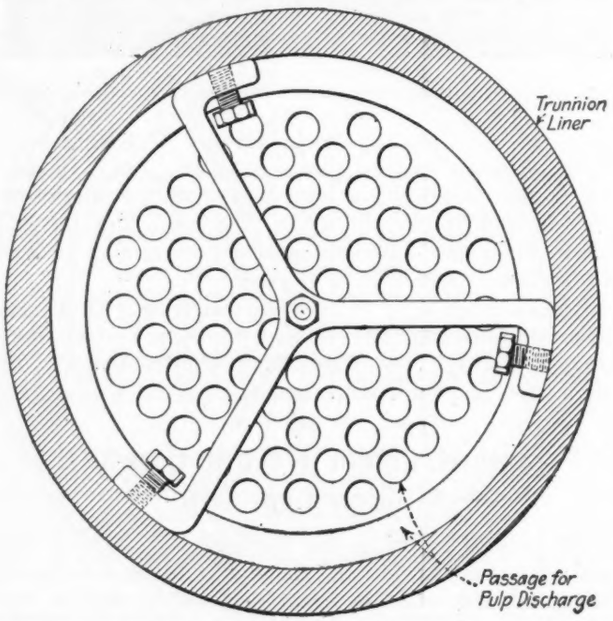
Distribution of labor is shown as follows:

Day shift, 8 a.m. to 4 p.m.	1 crusher man 1 millman 1 solution man 1 precipitation man
Night shift, 4 p.m. to midnight	1 millman 1 solution man
Graveyard shift, midnight to 8 a.m.	1 millman 1 solution man

Tube Mill Discharge Screen

By A. W. Allen*

Tube mills are usually filled with pebbles to a point on a level with or slightly above the center line. This necessitates a screen at the discharge end, which serves two purposes—to permit free discharge of pulp and also pebbles and broken rock of a size too small to be of any grinding value in the mill, and to retain the larger pebbles. It is also convenient if the discharge screen



RETAINING PLATE FOR TUBE-MILL DISCHARGE OPENING

permits the examination of the interior of the mill during operation, and it should be capable of quick and easy removal. The ordinary circular grizzly screen is inclined to become "blinded" and is difficult to remove, as it invariable becomes tightly wedged in the liner with sand.

In order to insure maximum discharge and to obviate the other disadvantages mentioned, a screen according to the accompanying cut was designed and proved satisfactory in practice. This consists merely of a circular plate of steel punched with holes of a predetermined size (according to pebble-discharge requirements) and of a diameter equal to the inside diameter of the trunion liner less the combined diameter of two holes. This plate is bolted centrally to a "spider," which in turn is held in place against the trunion liner by means of three setscrews. The threads of the latter should form a tight fit with the tapped holes in the "spider," and no locknuts will then be necessary.

*Metallurgical engineer, 309 Broadway, New York.

Density-Composition Relations in Copper-Sulphate Electrolytes

According to a recent publication of the Bureau of Standards ("Sci. Paper No. 275) the effect on the density of an electrolyte of one gram per liter of $CuSO_4.5H_2O$ is practically identical with that produced by 1 gram per liter of H_2SO_4. Therefore, if the density of a solution containing these substances be known, then the amount of the two in grams per liter is also known. If the amount of either then be determined, the other may be found by difference. The accompanying table is given of the effect of the substances.

CONCENTRATION OF ELECTROLYTES OF GIVEN DENSITY

Density	25° C. Grams per Liter $CuSO_4.5H_2O+H_2SO_4$	Density	40° C. Grams per Liter $CuSO_4.5H_2O+H_2SO_4$
1.01	20	1.01	.26
1.02	36	1.02	.43
1.03	52	1.03	60
1.04	68	1.04	76
1.05	84	1.05	93
1.06	100	1.06	110
1.07	117	1.07	127
1.08	133	1.08	144
1.09	150	1.09	161
1.10	166	1.10	178
1.11	183	1.11	195
1.12	200	1.12	212
1.13	217	1.13	229
1.14	234	1.14	247
1.15	251	1.15	265
1.16	268	1.16	282
1.17	286	1.17	300
1.18	303	1.18	318
1.19	321	1.19	336
1.20	339	1.20	354
1.21	357	1.21	372
1.22	375	1.22	390
1.23	393	1.23	408
....	...	1.24	427

Rustproofing Iron and Steel

Rendering iron and steel rustproof by changing the surface to basic phosphate salts of iron is the basis of a recent patent, says *Page's Engineering Weekly,* Oct. 13, 1916.

Iron placed in a weak solution of phosphoric acid is attacked and an adherent coat of insoluble ferrous phosphate is formed, which an oxidizing agent makes basic in character and black. The patentee takes advantage of the fact that the more acid phosphate salts of calcium, magnesium, barium, or other alkali earth metals in solution, react much less violently than when free phosphoric acid is present. By using hydrated manganic oxide and air as oxidizing agents in the presence of this acid phosphate, a layer of ferrosoferric phosphate is formed of suitable thickness and black, rendering the metal rustproof.

Acid-Resisting Bags for Filtering Smelting Gases have been patented by Donald M. Cameron, of Lowell, Mass., who states that camel's hair or other fibers, which have longitudinal striations, are more resistant to acid gases than wool because there are no lines of weakness at right angles to the long axis. The difficulty with wool fiber is stated to be the weakening of the wool at right angles to the thread on account of the scale-like formation which is characteristic of its structure. Mr. Cameron's patent (U. S. Pat. 1,190,512, July, 1916) specifies a bag "composed of yarn constructed of fiber, the striations of which are longitudinal and free of scale-like formation."

Events and Economics of the War

Results of the past week show a balance in favor of the Allies. The success of the English blow at Messines proves the superiority that may yet be fatal to the Germans. The naval raid on Ostend is said to have greatly lessened that port's value as a submarine base.

An invasion of Italy by Mackensen with troops from the Eastern front is said to be threatened. The Italians are on the defensive on the Carso but are attacking in the Trentino.

Russia remains inactive. The voice of revolt is heard both in Sweden and Spain, where most of the people are pro-Ally.

The U-boat continues less effective, whatever may be the reason.

In this country the chief items of importance have been the success of registration and the final drive for the Liberty Loan.

Taxes Versus Loans

In a discussion of the House Revenue bill, Edwin R. A. Seligman, the Professor of Political Economy at Columbia, says in part:

If war expenditures cannot be defrayed entirely from loans or entirely from taxes, the problem remains, what should be the proportion between loans and taxes?

It is easily to be seen why Secretary McAdoo shrank from placing an undue reliance upon loans. He had before him the warning example of Secretary Chase during the civil war, whose undue reliance on loans soon compelled the Government to resort to the fatal expedient of greenbacks, from which it took us fifteen years to extricate ourselves. But when he hit upon the plan of 50-50%; that is, of raising one-half of all domestic war expenditures by taxes, the question arises whether he did not go too far.

The relative proportion of loans to taxes is a purely business proposition. Not to rely to a large extent on loans at the outset of a war is a mistake. Modern business is based upon credit. To abandon the use of credit is to revert to primitive economic conditions and to lessen social productivity. But the loans incurred by the Government must be proportioned to its earning capacity; that is, its taxes. If these are too low its credit will suffer; if too high the social productivity will suffer. High taxes should, indeed, be levied. But taxes ought to be imposed only up to this danger line which marks the impairment of social productivity. In the first year of a great war, where the maintenance of stable business conditions is of the utmost importance, a large part of the war expenditures should come from loans. To do otherwise would be to fly in the face of business practice.

The disadvantages of excessive taxes at the outset of the war are:

1. Excessive taxes on consumption will cause popular resentment.

2. Excessive taxes on industry will disarrange business, damp enthusiasm, and restrict the spirit of enterprise.

3. Excessive taxes on incomes will deplete the surplus available for investments and interfere with the placing of later loans.

4. Excessive taxes on wealth will cause a serious diminution of incomes which largely support educational and philanthropic enterprises.

5. Excessive taxation at the outset of the war will reduce the elasticity available for the increasing demands that are soon to come.

The fifty-fifty policy has never even been remotely approached by any country in the world. It is difficult to see what reasons exist to warrant the adoption of such a course. Take Britain as an example. During the first year she increased taxes only slightly, in order to keep industries going at top notch. During the second she raised, by new taxes only 9% of her war expenditures. During the third she levied, by additional taxes (over and above the pre-war level), only slightly more than 17% of her war expenses.

Is there not a wide discrepancy between the 17% imposed by Great Britain in the third year of war and the 50% sought to be imposed in the first year of our war?

Eustis and Clark Dropped by Goethals

As a result of their denunciation of General Goethals in the row over the building of wooden ships, F. A. Eustis and F. Huntington Clark are out of the Emergency Fleet Corporation. Eustis, Assistant General Manager of the corporation, and Clark, both of them mining engineers, who are convinced not only that the program to construct 1000 wooden ships was practical, but that its adoption might be the deciding factor in the war against Germany, broke over the traces on June 7 and in formal statements placed their case before the people.

The statement in which it was intimated that General Goethals was throwing away 2,000,000 or more tons of wooden ships which could be built without interfering with his steel ship program, was the direct outgrowth of the address the General made in New York before the Iron and Steel Institute, when he characterized the wooden ships plan as "hopeless." This address was made without consultation with Chairman Denman of the Shipping Board or any other member of that board of the Executive Council of the Emergency Fleet Corporation.

In a letter to Mr. Denman, Gen. Goethals said: "The usefulness of these two gentlemen in this organization is at an end. Mr. Eustis was retained at your suggestion and given a position of responsibility. How he has fulfilled his duties his statement to the press discloses.

"Under the circumstances, I am accepting the resignation of Mr. Eustis as a member of the Executive Committee of the United States Emergency Fleet Corpora-

tion and discharging him from the service for lack of loyalty and misstatement and misrepresentation of fact. This applies to his employment with the corporation, and, of course, has no bearing on the dual position he occupies as agent of the Shipping Board. Mr. Clark is to be dismissed from the service for similar reasons."

Mr. Eustis is still in the employ of the Government as Shipping Board Agent and has no intention of resigning from the Shipping Board unless he is asked to do so.

Hope for Russia

The most heartening sign of the times in Russia is the firm and enthusiastic determination of all the ablest business men of the nation that the new republic shall remain faithful to the Allies and shall make no separate peace with Germany.

There has just ended here the largest meeting the Union of Commerce and Industry ever has held. This union is similar to an American chamber of commerce. Its members are the progressive business men, the manufacturers, the bankers of Russia.

These men discussed the whole situation of Russia and the war. They listened to speeches by their most prominent members. They heard what representatives of all the allied embassies had to say.

And then, not only without a single dissenting voice, but amid storms of cheers, they passed a resolution which ends in these words:

"However heavy the trials may be which fate has in store for Russia and her allies, Russia will remain faithful to the end to those allies, to whom she is plighted for life and death. Russia will not live with the brand of traitor on her forehead and eternal remorse and shame in her heart."

Neutrals' Food in Neutral Ships

Neutral Governments are to be informed by the new American food administration that if they wish foodstuffs and other commodities from the United States they will have to furnish virtually all the shipping for its transportation. The shipping problem is of the gravest concern to Hoover, who is understood to have decided upon a plan which will free American vessels for the allied trade almost exclusively.

One plan involves the taking over by neutral shipping of a large part of America's Pacific trade where at present there is no danger from submarines. This will allow the diversion of American shipping in that trade to the transatlantic trade with the allied Governments.

The embargo powers conferred in the espionage bill will be a powerful weapon in the hands of the food administration to induce the neutrals to employ their shipping so that this country can concentrate its energies on supplying its allies.

The food administration has been greatly disturbed by the row in the Shipping Board and the Emergency Fleet Corporation at a time when the greatest harmony and haste in ship construction are imperative. Italy, according to the Italian mission, is in serious need of coal so that her railroads and munitions plants may be kept running.

Negotiations are under way with Brazil to have the 40 German ships seized by that Government put into the North and South American trade if possible, so that the American ships now on those routes also may be released for the allied trade so far as they are suitable.

Miners Exempt from Draft

The Federal Trade Commission has recommended strongly to Congress that coal miners be exempted in the army draft and that everything possible be done to urge them to remain at their normal tasks.

Building the Ships

Gen. Goethals, general manager of the Emergency Fleet Corporation of the Shipping Board, announced May 24, that 38 contracts had been executed to date for steel and wooden steamships. The list of ships contracted for follows: Merrill-Stevens company, Jacksonville, Fla., 12 wooden cargo-carrying steamships complete and four cargo carrying all steel ships complete; Los Angeles Shipbuilding and Dry Docking Co., Long Beach, Cal., eight cargo-carrying all-steel ships complete; G. M. Standifer Construction Corporation, Portland, Ore., 10 wooden cargo-carrying steamships complete; Peninsular Shipbuilding Co., Portland, Ore., four wooden cargo vessels complete.

Engineer Regiment Order

The commanding generals of the departments in which the following named Reserve Engineer Regiments are stationed have been directed to order into active service any or all members of the Enlisted Reserve Corps who have been assigned to such regiments whenever their services may be required under the mobilization plans: First Reserve Engineers, New York City, Second Reserve Engineers, St. Louis, Mo., Third Reserve Engineers, Chicago, Ill., Fourth Reserve Engineers, Boston, Mass., Fifth Reserve Engineers, Pittsburgh, Penn., Sixth Reserve Engineers, Detroit, Mich., Seventh Reserve Engineers, Atlanta, Ga., Eighth Reserve Engineers, San Francisco, Calif., Ninth Reserve Engineers, Philadelphia, Pennsylvania.

Mr. Dodge's Gift to the Red Cross

One million dollars was contributed the other day by Cleveland H. Dodge to the American Red Cross, on condition that 24 others give a like amount each. Mr. Dodge is chairman of the finance committee of the Red Cross war council, which is seeking to raise $100,000,000 toward the fund. Announcement of this generous contribution was made by Seward Prosser, chairman of the executive committee. In discussing the gift Mr. Prosser said:

"Mr. Dodge's gift is conditional, but I am confident, as we all are, that the conditions will be fulfilled and thus bring to us Mr. Dodge's $1,000,000 in bulk. Mr. Dodge believes that in order to raise $100,000,000 it will be necessary to obtain at least $25,000,000 in contributions of $1,000,000 each.

What the German Army Surrendered

"The liberated territory around Liévin and Lens," a Paris financial correspondent writes to London, "contains some fifteen groups of collieries, which in times of peace produced coal to the extent of some 4,500,000 tons a year. The Germans do not appear actually to have worked these coal-fields, but the machinery has been destroyed, and the pits have been flooded, so that it is estimated that from eighteen to twenty months will be necessary before coal-getting can be resumed."

The Naval Contracts

Secretary Daniels announced on May 21 that all naval vessels authorized by Congress had been contracted for except three dreadnoughts and a few minor auxiliary craft. Besides the war-craft specifically provided for, the department had ordered many additional destroyers, submarine chasers by the hundred, and added today twenty-four seagoing tugs of 1000 tons displacement, to be used both as towboats and mine sweepers.

The submarines, destroyers, and tugs all will be built on the cost-plus-ten-per-cent. profit plan, the Navy Department arranging for the delivery of material.

To Buy Alaska Railroad

Secretary Lane announces that arrangements are being made for the purchase of the privately owned Tanana Valley Railroad. This road runs from Fairbanks to Chatanika, with a branch to Chena, and traverses a country of agricultural and mineral wealth. It will become a part of the Government railroad system now under construction in Alaska, the main line of which runs from Seward to Fairbanks and will make available for mining operations in the Fairbanks district the coal in the Nanana

Petroleum Gesellschaft, the chief German subsidiary, the main line.

Computations of the experts in the Quartermaster Corps, says the *Army and Navy Journal,* show that the next estimates for subsistence of the army will have to be on a basis of a 32c. daily ration, as compared with 27c. only four months ago. A further indication of the effect of the rising cost of all materials is shown in the statement that the per capita cost of "personal equipment" in the Q.M.C. estimates for the new army is $194, against $175 about six months ago. This equipment includes shoes, socks, uniforms, half of a shelter tent and other things necessary to place a man in the field after his arms are supplied. In the case of rifles the cost has jumped in a year from $12.50 to $19.50.

Berlin *Zeitung am Mittag* says: "We do not underestimate the American danger where it really exists, namely, after the war on commercial questions, but for the Entente's momentary needs America has nothing to offer but a blown egg-shell." It adds that the loans to France and Italy so far amount to a mere tip to keep those countries quiet. "Out of mountainous millions promised develops a puny advance of $100,000,000 for Italy and France. Italy gets pocket money to the tune of $25,000,000. What we Germans dreaded becomes a terrible reality. American millionaires propose to take the field with muscles and money bags against the German empire."

Vice President Dixon of the Pennsylvania R.R. argues that the 15% increase in freight rates demanded by railroads would not only be a business tonic, but would actually lower the cost of living. For a family living in an interior city like Pittsburgh he found that the increase would add only 3.683c. to the total cost of its weekly supply of food. With that money, he says, the railroads would so increase terminal and transportation facilities that eventually the prices of foodstuffs would be decreased far more than the proposed freight rate increase.

According to the Boston *Globe* the action of Allies in discontinuing J. P. Morgan & Co. as fiscal agents will save them over $100,000,000 commissions on $3,000,000,000 American loan to be spent here. Future transactions will be handled direct with Federal Reserve banks. It would be interesting to know how much J. P. Morgan & Co. had saved the Allies by intelligent buying. An ordinary buying commission is 2%. It costs money to buy well, just as it does to sell.

Domestic asbestos production can be stimulated greatly, J. S. Diller states in his report to the Geological Survey covering the war conditions affecting this mineral. He urges intensive prospecting in all areas of peridotite and pyroxenite rocks more or less altered to serpentine. He points out the necessity of conserving the Arizona supply of high-grade fiber, with its small percentage of iron which makes it so necessary for use in electric insulation.

It has just been learned that the Standard Oil Co. of New Jersey sold its stock in the *Deutsche-Amerikanische Petroleum Gessellschaft,* the chief German subsidiary, more than two years ago, when it became evident that the war would involve the United States.

The United States Railroad Commission to the Russian Government, headed by John F. Stevens, former Chief Engineer of the Panama Canal, arrived in Vladivostok on June 2.

On June 4 the British fleet attacked Ostend, damaging it to an extent such as to impair its use as a German base. The German destroyer S-20 was sunk in this action.

Italy and Russia already have missions in this country, and Norway is about to dispatch one which will include the explorer Nansen.

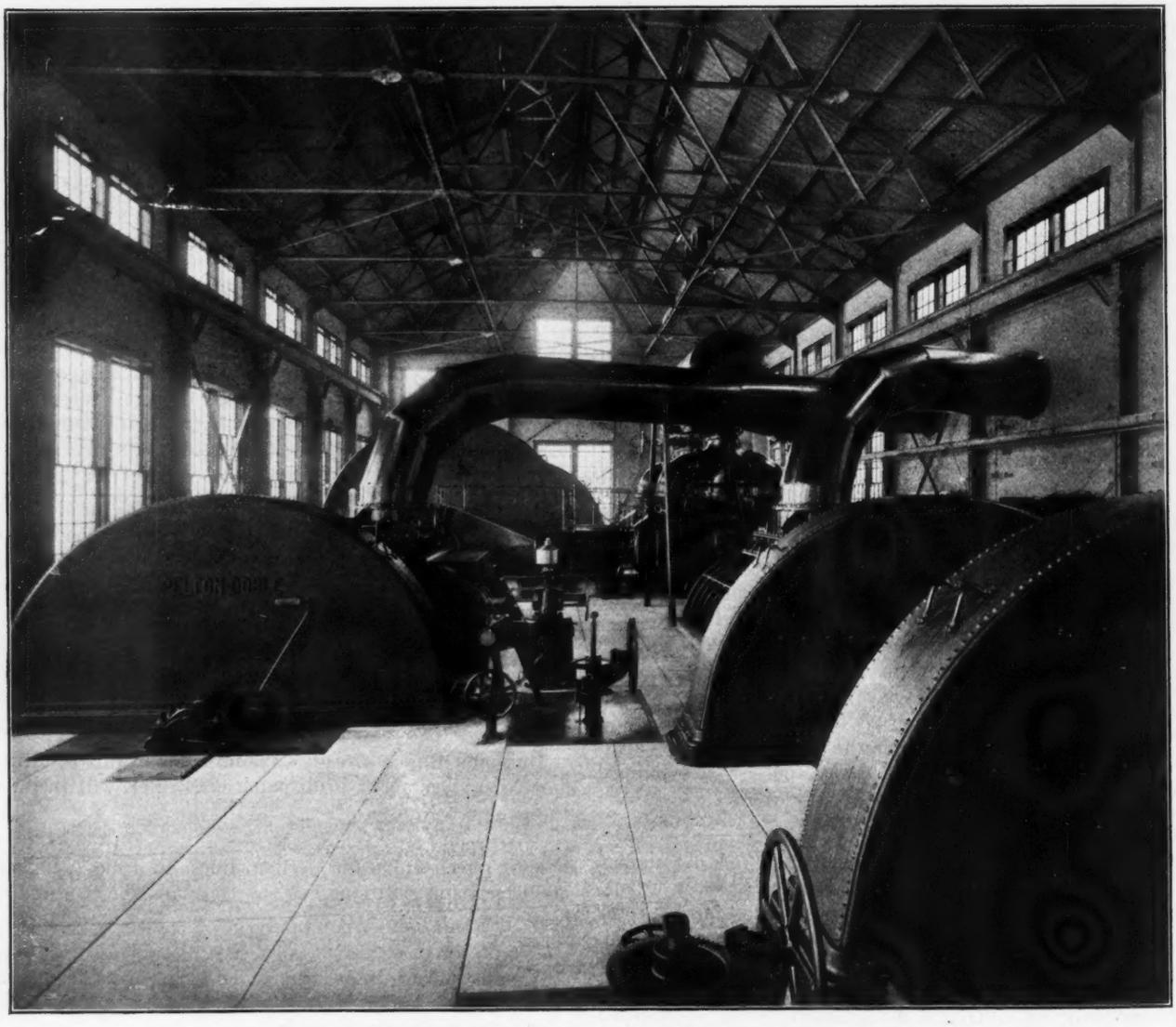
Haig's men broke the German lines, on June 7, taking 5000 men and positions held by Germans for two and a half years.

An invasion of Italy by Austria with troops from the Russian front under Mackensen is feared.

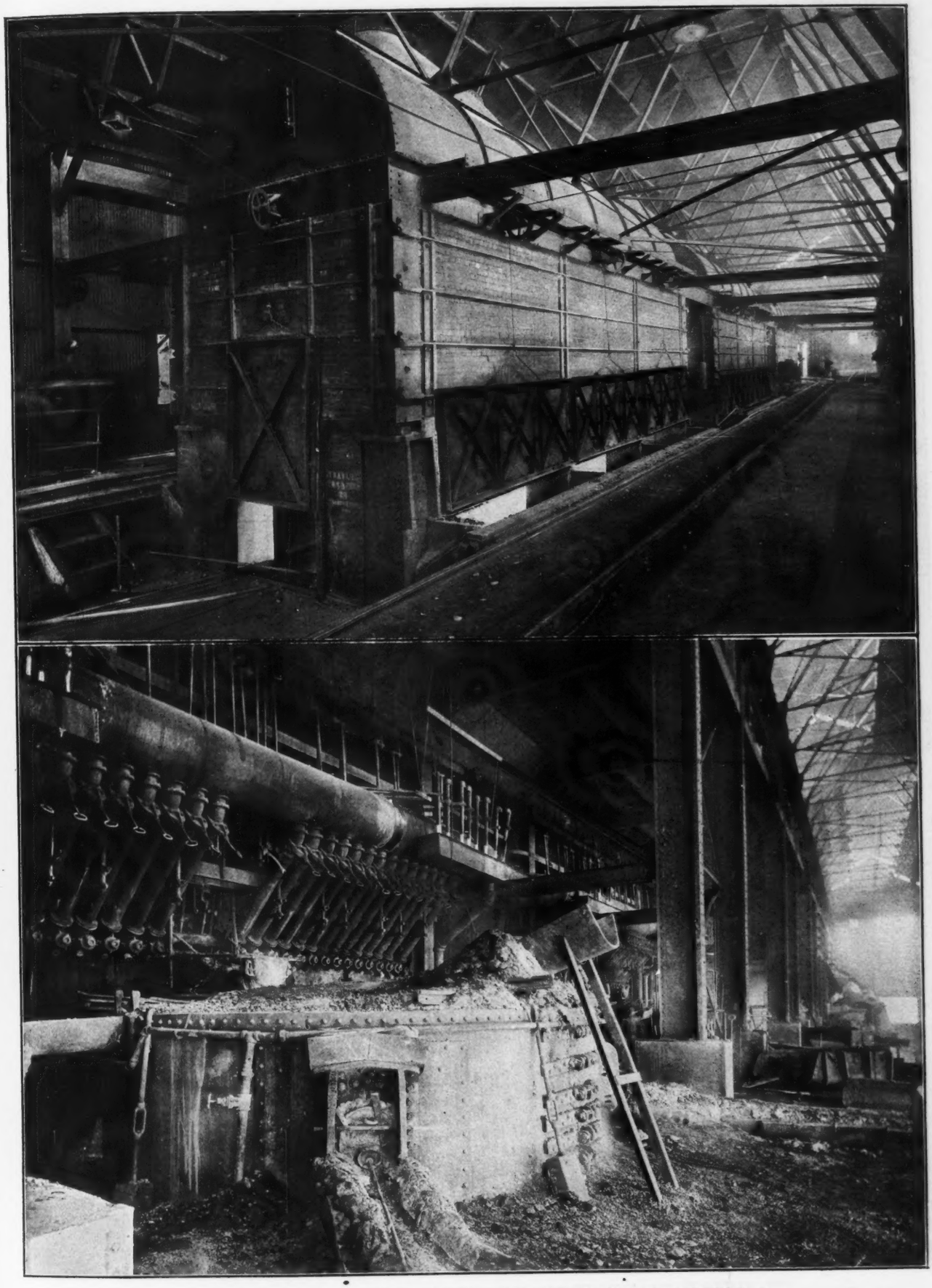
Gen. Pershing and staff arrived in England on June 8.

Granby Smelting Works, Anyox, B. C.

GENERAL VIEW OF SMELTING WORKS AND POWER PLANT OF GRANBY CONSOLIDATED MINING, SMELTING AND POWER CO., LTD.

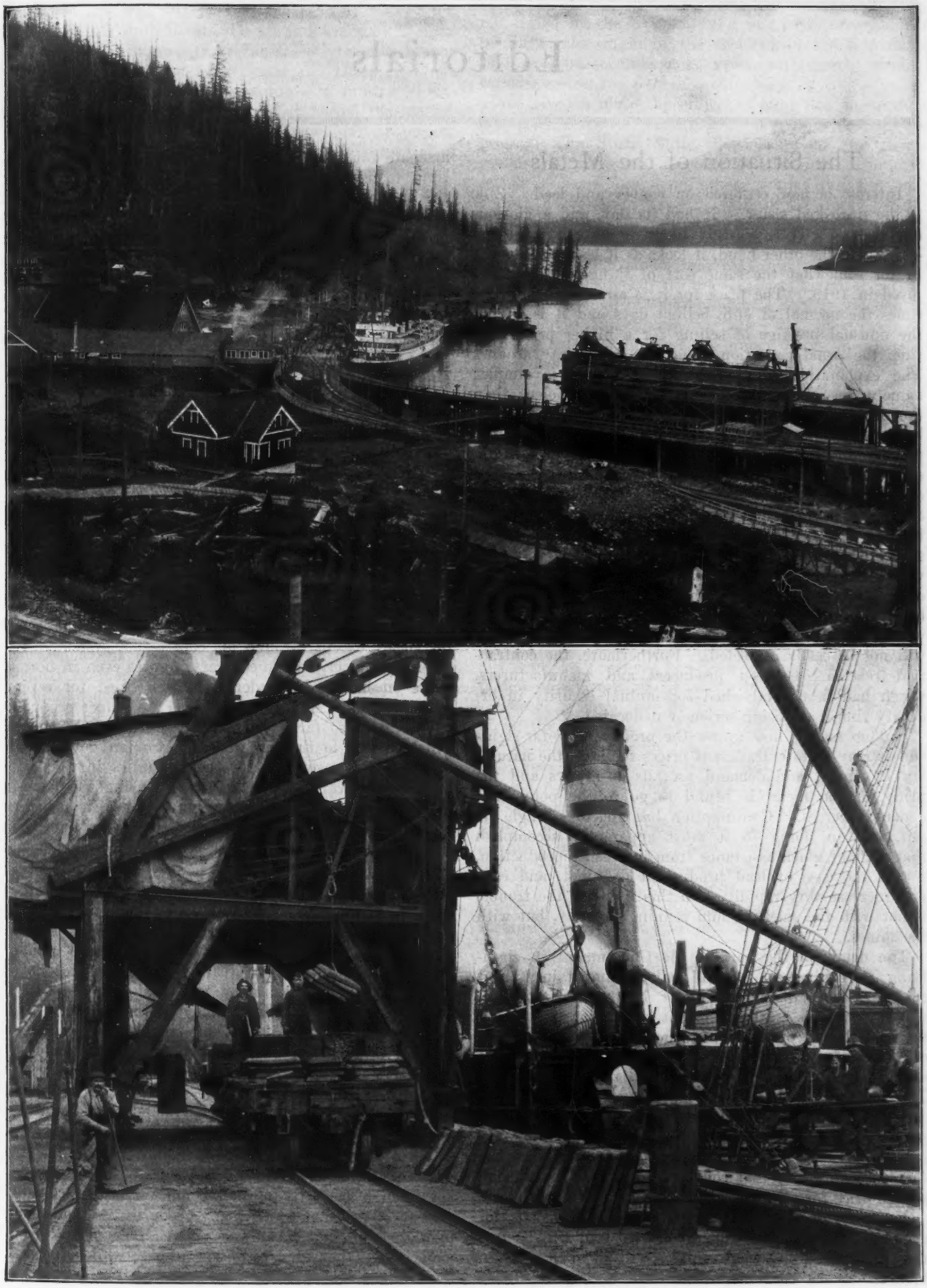


INTERIOR OF THE GRANBY POWER HOUSE AT ANYOX, B. C.
Showing waterwheels and blowers for the blast furnaces



FEED AND TAPPING FLOORS OF THE GRANBY FURNACES AT ANYOX, B. C.

TWO VIEWS IN THE CONVERTING DEPARTMENT OF THE ANYOX SMELTERY



DOCK SHOWING BINS FOR RECEIVING ORE, AND THE LOADING OF CONVERTER BARS AT ANYOX, B. C.

Editorials

The Situation of the Metals

Interest is now centered on copper and lead. Zinc is the neglected sister. It had its day, and a glorious day it was. It is scarcely likely to have a repetition of it. On the other hand, it looks as if lead was coming in for somewhat the same sort of thing that zinc enjoyed in 1915. The price for it is already about three times the normal of ante bellum days and it is having the unusual prestige of selling for a higher price than zinc, the usual condition being the other way around. The explanation of the situation in lead is simple; namely, the consumptive demand is more violent than the productive ability. Now, lead production is made by fewer and stronger concerns than is zinc. It is not possible for new people to go into the business so readily as it was in zinc. Nor is there the same extravagance of ideas, the same relish of inflated prices. On the contrary, the principal producers deprecate the advance to high levels. They have done all they could to restrain it. They know that high prices inevitably prevent some of their customers from using lead, and some day they will want those customers whom high prices have driven away. They know, moreover, that there will inevitably be a disturbance of labor conditions that will not be easily corrected. Furthermore, the contractual relations between producers and manufacturers, which had been established for mutual security in ordinary times, are being seriously dislocated.

But no matter how averse the producers of far-sightedness may be to extravagant prices for lead, the natural law of supply and demand prevails as always and the price for the metal is bound to go to the point that demand decrees. Consumption has got to strangle itself, and in doing so it must apparently accomplish that without much assistance from increasing production, for in the case of lead production does not, and cannot, increase very rapidly. In this industry the trouble is not with the smelting and refining capacity, but with the mines.

The delay on the part of the Government in signifying its requirement for lead and the uncertainty about that is a very disturbing factor in the market. Involved with this is the fact that the major part of all the lead that is produced is turned over to the consumers (manufacturers) on average price contracts. At any time the quantity of free lead is relatively small. The reason why the outside market, as it is sometimes called, has lately ruled higher than the contract price published by the American Smelting and Refining Co. is simply that so large a part of the production is booked for consumption at that contract price. If it were not so, the price for all the lead would manifestly be a mean.

Now, if the Government comes in and contracts for a quantity of lead, the amount of free lead will be further diminished and what remains will go to the highest bidder. Some consumers will have to buy it almost regardless of price. Thus, the manufacturer of lead arsenate for horticultural spraying would probably continue to take in lead at a much higher price; similarly, the builder of sulphuric-acid chambers. But the point will be reached at which the plumber will use galvanized pipe instead of lead pipe, and the corroder will lose business to the manufacturer of zinc and barium pigments and through people postponing the painting of their houses.

But it is possible that the Government's requirement for lead might exceed the present tonnage of free lead, in which event the existing contracts would have to be trimmed down by *force majeure*. In other words, the Government, probably through the lead committee, would restrict the lead to be supplied for ordinary consumption. Whether it would do that pro rata, or whether it would give preference to indispensable uses, or what it would do, nobody knows. The whole question is highly complicated, and because it is so and because of the uncertainty are some reasons why the lead market is behaving as it is.

The copper market also is very strong, but in an orderly way. Here likewise the delay on the part of the Government is a factor, but perhaps less so than in the case of lead. The lead producer does not normally sell far ahead, except through his contractual system. The copper producer, on the contrary, figures even in normal times on having his order book well filled for several months ahead. At the present time the copper producers are not sold so far ahead as they were last November, which is due to the fact that the foreign governments have not yet negotiated for their supplies in the latter half of the year. There has been during the last six weeks some very good domestic business, which has probably been placed in anticipation of congestion later, just as there was active business last fall immediately before the placing of the great orders.

The great economic factor in the copper market at present seems to be that production does not increase much in spite of increased refining capacity. An explanation of this may be that our plants have been so taxed during the last two years that they cannot do so much as they used to, along with which is diminished efficiency of labor. Thus it may be that when we had a refining capacity of 2½ billion pounds per annum we got 100% efficiency, while with three billion pounds of capacity and 83⅓% efficiency we would get only the the same production as formerly. These figures are not given as statistics, but are offered merely as illustrating an idea.

The situation in zinc may be dismissed with the few words that smelters have unsold stocks. The zinc market is in a perfectly normal condition on an elevated plateau of price, at which many producers do not, owing to higher costs of labor and material, make any more money than they used to at low proces, while of course those miners who produce high-grade ore still reap fabulous returns.

The Ship Controversy

The dismissal of Messrs. Eustis and Clark by General Goethals is of interest to us for several reasons, among which is the fact that both Eustis and Clark to whom the idea of wooden ships was due, are mining engineers. We had pride in seeing what looked like an extraordinarily useful idea emanate from our profession, which we hold to be the most versatile and broadest of all the engineering branches. Now, when America went into the war and the Government committed itself to a shipbuilding program, the man to whom all eyes turned naturally was General Goethals. His was the name to conjure with. He was marked as the shipbuilder just as Hoover was as the food administrator. In them the public had confidence, and under them ships could be built and food supplies could be administered. Without Goethals the project of building ships, wooden or any other kind, would probably have been still a matter of academic discussion.

We have heard that General Goethals is a man of arbitrary methods. The man who does things, such as building Panama Canals, is apt to be. He is likely to have but little patience with stockholders' meetings, or Congress, or politicians, or even with subordinates. It is well known that almost from the day of his appointment, General Goethals had friction with Mr. Denman, chairman of the Federal Shipping Board. He also had friction with Mr. Eustis and Mr. Clark. The friction was undoubtedly mutual, but who was the sandpaper and who the board we do not pretend to say.

As between General Goethals and Mr. Denman the matter was hushed up (by Mr. Denman). If it had ever come out and become subject to the verdict of popular opinion, is there any doubt as to what would have happened to Mr. Denman? He would have lasted about as long as a snowball in—well, in Death Valley in August. As between General Goethals and Messrs. Eustis and Clark the General simply fired them for insubordination. They naturally felt chagrined that their scheme for wooden ships had not been preëminently adopted. General Goethals had decided that standardized steel ships would better be built. We think that Messrs. Eustis and Clark were ill-advised. They might have assisted in the building of a fleet on the lines they dreamed, although perhaps not so extensively as they hoped and not as the means of salvation on which all eyes were centered, but probably they would have got something and in that connection, and others, would have done useful work for the country; whereas, as it is, no matter what may be their grievances, the country says "General Goethals dismissed them. So be it," and thinks no more of the matter.

The North Butte Fire

The fire in the Speculator shaft of the North Butte Mining Co. at Butte, Mont., on June 9, was one of the greatest calamities in the history of American metal mining, indeed of metal mining anywhere. The total loss of life is not yet known. It looks as if it would be upward of 100. This is greatly in excess of the fatalities in the fire in the North Mount Lyell mine, Oct. 12, 1912, when 42 were killed, which was characterized at that time as the most disastrous metal-mine accident of recent years.

So far as we can judge from the information communicated by the company and our own correspondent in Butte, the origin of the accident in the Speculator shaft was pure carelessness, gross carelessness, criminal carelessness on the part of a shift-boss.

We have discussed the subject of mine fires in previous editorials in the *Journal* upon the occasions of other disasters. The North Butte fire teaches no new lesson, reveals no previously unsuspected danger. The comments of years ago upon other, similar disasters may simply be reiterated now. Fire is the most terrible disaster that is likely to happen in a metal mine, and the only sure way to avoid it is eternal vigilance and the exclusion of all chances that may result in ignition of inflammable material, no matter how trivial they may be. A very small fire may produce a very great quantity of poisonous and suffocating gas—very great as compared with the volume of the underground openings in which it is confined—and cause great loss of life.

The other lesson of the North Butte fire is also nothing but a repetition of the old ones; namely, the importance of providing more than one outlet from all parts of the mine where it is possible to do so. North Butte was probably not derelict in that respect, for we read of some of its men escaping through other workings and into other mines. But it was impossible in North Butte, nor is it possible in any mine, to provide two outlets from every part. The mere act of driving a drift creates temporarily at least, a blind alley, and in every mine there is bound to be a certain number of such traps; that is, workings from which there is only one outlet. Some of the men who were rescued from the North Butte mine walled themselves in such a place and kept the poisonous gas from entering, living in their pocket of air until the rescuers relieved them.

The only thing that we think of that might have reduced the fatality in the North Butte mine, the accident having happened, is an immediate general alarm. That may have been given in North Butte. The reports so far say nothing on that subject. The press dispatches do speak, however, of men being overcome by the invisible, odorless, poisonous gas before they knew that anything was wrong. Every mine should have a system of general alarm, such as flashing the electric lights, the meaning of which is understood to be that some grave danger is impending and that every man should instantly make his way out of the mine by certain routes.

The New York Section of the American Institute of Mining Engineers has decided that, as a patriotic duty, regular monthly meetings will be held throughout the summer. The Government is known to be attacking some serious problems connected with the metals, and the members believe that they may be of material assistance in their solution. Since it is important that as many minds as possible be concentrated upon these problems, it is urged that every engineer should make it one of his duties to be present. The problems will be presented to the Section through the medium of personal addresses by Government officials and technologists.

The total amount subscribed to Belgian Kiddies, Ltd., up to date is $97,307.91.

BY THE WAY

The first issue of "The Spelter Journal," the new organ of the Butte & Superior Mining Co.'s safety and efficiency department, has reached us. By way of introduction it is pointed out that the initial issue of the magazine is not intended to mark the inception of the Safety First organization at the property, but to serve as an aid to further efficiency. Publications of this kind perform useful work—we wish success to this one.

According to the annual report of the American Telephone and Telegraph Co. 93% of the total of 19,850,315 miles of wire in use in their service is copper. The 11,468,525 miles of underground conduits and cables represent an outlay of $223,000,000. How would you like to take a contract to lay a mile of telephone wire in a conduit underground, "finding" wire, conduit, labor and your own profit in $22, which is what each mile averages the Bell Telephone company?

North Butte Mine Fire

BUTTE CORRESPONDENCE

The most disastrous fire in the history of metal mining broke out in the Granite Mountain shaft of the North Butte Mining Co., about midnight on Friday, June 8, and has apparently cost the lives of about 162 men (75 known dead and 88 missing) causing a direct material loss to the company on account of damage to the mine, and a further loss of about one million dollars as compensation to relatives and dependents of the miners. In spite of many serious and peculiar fires that have broke out in various large copper mines of the Butte district in particular, this latest and most disastrous fire is generally accepted as a result of another accident. Ernest Sallau, assistant foreman at the mine, who was killed, caused the fire by allowing his carbide lamp to come in contact with the insulation of a large cable which was being lowered into the mine and got away from the ropemen. It fell to and piled at the 2400-ft. station. While examining the broken cable, Sallau was warned by an assistant that he was too close to the cable with the lamp. Sallau paid no attention to the warning and the insulation caught fire. The assistant extinguished the fire and again warned Sallau and then turned away to other work. Sallau again set fire to the cable and the blaze instantly spread, attacking the timber of the shaft.

Before the mine was filled with smoke only nine of the 423 men employed on the shift had escaped from the mine. Others later fought their way through drifts to adjoining mines and then breaking down bulkheads making their escape. Several groups of miners walled themselves in blind drifts and shut out the smoke and gas. Thirty of these had been rescued alive on June 11. Manus Duggan, 27, a nipper, was one of the heroes of the disaster. He led 29 men away from the gas and got them to build a bulkhead in a blind drift on the 2200 level where he held them for 38 hours. When the air became bad, the men wanted to break down the bulkhead and go into the gas-filled drifts. By persuasion and force, Duggan held them to the last possible minute. When the air outside had improved, he led them to the shaft, where he rang for a cage. While the cage was descending, Duggan suddenly lost his head and told the men to follow him. Three obeyed and they disappeared in the direction whence they had come. The dead body of one of the four has been found but Duggan and two companions are still missing, there being little doubt that they are now dead. The 24 men who waited at the shaft were rescued. The safety-first and helmet crews of the Anaconda mines, and the safety men from the U. S. Bureau of Mines did heroic work in searching the mine for survivors and bringing out the dead. Men at pumps remained at their posts until they dropped unconscious from gas.

The first official statement, issued by the North Butte Mining Co., from information in its hands on June 12, follows:

NORTH BUTTE MINING CO.'S STATEMENT

About midnight on Friday, June 8, 1917, a disastrous and distressing fire occurred, with considerable loss of life, in the Granite Mountain shaft of the North Butte Mining Co., starting on the 2400-ft. level. From reliable information obtained from the Butte mine office of the company, the fire is attributed to the following cause: While lowering an electric cable on a messenger rope in the Granite Mountain shaft, the cable accidently slipped and was carried down the shaft. In the fall the lead protective covering was torn from a considerable portion of the cable, exposing the oiled-fabric insulation. In cutting away the cable to remove it from the shaft, a light was placed by some employee too near the cable, setting fire to the oiled fabric and the flame running up the cable set fire to the shaft timbering.

The air current at the Granite Mountain shaft is downcast and the gases, part of which are almost odorless and are colorless and tasteless, affected the lower workings of the mine, overcoming our workmen before they could be warned or themselves realize the presence of carbon-dioxide gas. The fans of the Speculator, Gem and Rainbow shafts, which are upcast, were immediately reversed in order to carry fresh air into the mine and change to upcast the current of air in the Granite Mountain shaft.

The alarm was spread throughout the mine and a large number of the men were taken to the surface in safety through the Speculator, High Ore, Diamond and Badger State shafts. Rescue work was immediately commenced by helmet crews from every available source and every effort was made to get the survivors out of the mine and to extend relief and succor to the suffering. The loss of life was undoubtedly due, in large part, to the deadly action of the insidious carbon-dioxide gas, and many of the employees were probably overcome at work without noticing or appreciating the fact that they were being affected.

At this time we cannot determine the exact number of dead, but from latest reports, it will probably be upward of 100. The property loss and the time it will take to repair the shaft cannot be determined just now. As the Speculator shaft has been recently retimbered, mining operations will be resumed through it as soon as possible.

The effective aid rendered by the management and men of the Anaconda mines, the Butte & Superior mine, the Tuolumne mine and by the officials and citizens of Butte, is acknowledged and most fully appreciated.

New Publications

Rivista del Servizio Minerario Nel 1915. Pp. 413. Ministero d'Agricoltura, Ispettorato Delle Miniere, Rome.

Geographic Tables and Formulas. Fourth edition. Compiled by Samuel S. Gannett. Pp. 388, illus. Bull. 650, U. S. Geological Survey, Washington.

The Southern Plains of Alberta. By D. B. Dowling. Pp. 200, illus. Memoir 93, Canada Department of Mines, Geological Survey Branch, Ottawa.

Petroleum in 1915. By John D. Northrop. Mineral Resources of the United States, 1915—Part II. Pp. 202, illus. U. S. Geological Survey, Washington.

Water Resources of the State of Oregon. Compiled and prepared under the direction of John H. Lewis. Pp. 353, illus. Bull. 4, State Engineer, Salem, Ore.

Fourteenth Biennial Report of the Bureau of Mines of Colorado for 1915 and 1916. Fred Carroll, Commissioner. 6 x 9, pp. 116. Colorado Bureau of Mines, Denver.

Some Facts and Figures About North Carolina and Her Natural Resources. Pp. 51; second edition. North Carolina Geological and Economic Survey, Raleigh.

Fifteenth Annual Report of the Temiskaming & Northern Ontario Railway Commission for Year Ended Oct. 31, 1916. Pp. 466, illus. A. T. Wilgress, Toronto.

Analyses of Western Australian Rocks, Meteorites and Natural Waters. By Edward S. Simpson. Pp. 197, illus. Bull. 67, Western Australia Geological Survey, Perth.

Geological Map of Michigan. Compiled by R. C. Allan, R. A. Smith and L. P. Barrett. 36 x 43½, unmounted. Michigan Geological and Biological Survey, Lansing, Mich.

Oxygen Mine-Rescue Apparatus and Physiological Effects on Users. By Yandell Henderson and James W. Paul. Pp. 102; illustrated. U. S. Bureau of Mines, Washington.

A Bibliography of the Geology and Mining Interests of the Black Hills Region. By Cleophas C. O'Harra. Pp. 216, illus. Bull. 11, Department of Geology, South Dakota School of Mines, Rapid City, S. D.

Report of Retracement and Permanent Monumenting of the Michigan-Ohio Boundary, Biennial Report of the Director, 1914-1916. Pp. 118; illustrated. Michigan Geological and Biological Survey, Lansing.

The Navajo Country. A Geographic and Hydrographic Reconnaissance of Parts of Arizona, New Mexico and Utah. By Herbert E. Gregory. Pp. 219, illus. Water-Supply Paper 380, U. S. Geological Survey, Washington.

Review of Work of the Commission of Conservation. By Sir Clifford Sifton. Pp. 16. Canada Commission of Conservation, Montreal.

Reprinted from the Eighth Annual Report of the Commission of Conservation.

Mine Taxation in the United States. By Lewis Emanuel Young. Pp. 275. $1.50. University of Illinois, Urbana.

This study is presented as a report upon the experience of the important report upon the experience of the important mining states in the taxation of mines and mineral lands. The investigation of the historical data of the laws was begun in 1910, and an effort has been made to include all important material published prior to November, 1916.

Ymir Mining Camp. British Columbia. By Charles Wales Drysdale. Pp. 185, illus. Memoir 94, Canada Department of Mines, Geological Survey Branch, Ottawa.

A description of the Ymir gold camp, which forms a part of the Nelson mining division of the West Kootenay district, British Columbia. Of the eight divisions in West Kootenay district, Nelson ranks third as a metal producer. At one time the Ymir mine was the largest gold mine in Canada. Very little geological work has been done there since the investigations of McConnell in 1897. The present report gives the results of later field work carried on in 1914.

Geology of Graham Island, British Columbia. By J. D. MacKenzie. Pp. 221, illus. Memoir 88, Canada Department of Mines, Geological Survey Branch, Ottawa.

The southern islands of the Queen Charlotte group are known to contain several deposits of economic minerals, the value of which has not yet been ascertained except in a preliminary way, and Graham Island, the subject of this report, has long been considered to have deposits of coal, lignite and petroleum. The search for workable bodies of these substances has been carried on at irregular intervals since 1859 and has lately been vigorously renewed. The report is the result of two seasons' exploration and study, in 1913 and 1914.

Tube Milling, A Treatise on the Practical Application of the Tube Mill to Metallurgical Problems. By Algernon Del Mar. 6 x 9 in., pp. 159; illus. $2. McGraw-Hill Book Co., Inc., New York.

Mr. Del Mar has accomplished a worthwhile service to the metallurgical industry by collecting in one volume most of the important data treating of tube mills and their operation. The general principles upon which tube mills are operated, the different kinds of mills in operation and the ways of handling them in different localities are well pointed out. The ball mill, an allied and similarly operated machine, is touched upon also and the general principles governing its operation are discussed. Mr. Del Mar's book is worth placing in every millman's library, where it will serve as a ready reference for the tube-mill operator.

Annual Chemical Directory of the United States. Edited by B. F. Lovelace. 6 x 9, pp. 305; $5. Williams & Wilkins Co., Baltimore.

The appearance of this directory at this time will be of great assistance in industrial preparedness to all those whom its contents concern. It includes complete lists of the American manufacturers of and dealers in acids, alkalies, colors, drug products, dyes, extracts, fertilizers, oils, preservatives, raw materials, salt, synthetic products and many other laboratory and industrial products. It also contains a list of American manufacturers and dealers in apparatus and equipment for the manufacture of the materials mentioned. It includes a list of various professional firms and consulting analytical and chemical engineers; laboratories; Federal, state, municipal, industrial and professional laboratories; American and foreign colleges offering courses in chemistry; United States and foreign experiment stations.

The Geologic Formations of California. By James Perrin Smith. Pp. 47, illus. Bull. 72, California State Mining Bureau, San Francisco.

This bulletin with the reconnaissance geologic map accompanying it is a report of progress for the period from 1891 since the preparation of the Preliminary Geological Map of California. Such unpublished material as could be obtained, together with a great mass of published information and data in maps and descriptive papers by the U. S. Geological Survey, California State Mining Bureau, California Academy of Sciences, Bulletins of the Department of Geology of the University of California and various scientific publications have been used in the compilation of the map and bulletin. Detailed legend for the geologic map is printed in plain type with symbols in the bulletin and in colors and symbols on the map. The bulletin also contains six geologic and geographic tables.

The Analysis of Copper and Its Ores and Alloys. By George L. Heath. 6 x 9 in., pp. 292; illustrated. $3. McGraw-Hill Book Co., Inc., New York.

This book covers the sampling, analysis and assay of ores, furnace products, rough and refined copper and copper alloys, with special chapters on metallography and resistivity testing. It is by far the best available work on this subject, but falls considerably short of being the best that can be written. The author is entirely correct in assigning much greater importance to sampling than is usually done, and his book deserves great credit for giving the proper perspective to the subjects of sampling and analysis. But on the other hand, to waste space in a small book in describing Mansfeld practice, merely because it is foreign and not commonly known, when it is a process applied to extraordinary ores and under circumstances requiring no remarkable accuracy, is poor judgment. Practically everything that can be desired in copper analysis is treated in the book, but it is distinctively a work for the advanced chemist, as discrimination must be exercised as to what to adopt from the processes given. Longer descriptions of the best processes should be given and inferior methods omitted. However, as said, it is the best treatise on the subject yet available.

Standard Methods of Chemical Analysis. A Manual of Analytical Methods and General Reference for the Analytical Chemist and for the Advanced Student. Edited by Wilfred W. Scott, in collaboration with H. A. Baker, L. C. Barton, F. G. Breyer and others. 6 x 9 in., pp. 864; illustrated. $6. D. Van Nostrand Co., New York.

This book is very well described by the author as being a "compilation of selected methods." The subjects are presented with enough detail to make them of value to the student, while, as each chapter is the work of an expert, it is also of value to the older practicing chemist. The chapters on aluminum, antimony, arsenic, barium, bismuth, bromine, boron, cadmium, calcium, carbon, chromium, fluorine, glucinum, iodine, iron lead, magnesium, manganese, mercury, molybdenum, nitrogen, phosphorous, selenium, tellurium, silicon, strontium, sulphur, tungsten, tantalum, columbium, uranium, vanadium and acids are by Mr. Scott himself. Those on cerium and other rare earths, thorium and zirconium are the work of R. Stuart Owens. Other chapters and contributors are: Chlorine, W. W. Scott and William F. Doerflinger; cobalt and nickel, W. L. Savell; copper, Scott and Wallace G. Derby, the latter also contributing the chapters on gold, silver and assaying; platinum and the allied metals, Reginald E. Hickman; potassium, sodium and other alkalis, W. B. Hicks; tin, H. A. Baker and B. S. Clark; titanium, Scott and L. E. Barton; zinc, F. G. Breyer; water analysis, D. K. French; fixed oils, fats and waxes and gas analysis, Augustus H. Gill; paints, Henry A. Gardner and John A. Schaeffer; cements, Richard K. Meade; analysis of alloys, John C. Olsen; and coal analysis, Frank E. Hale. Useful tables of constants occupy 44 pages of the book. In general each chapter is arranged according to the following outline; Physical properties, detection, preparation and solution of the sample, separation and methods of estimation. This book is a distinct contribution to technical literature.

The Principles and Practice of Sampling Metallic Metallurgical Materials. With Special Reference to the Sampling of Copper Bullion. By Edward Keller. 6 x 9, pp. 102. Bulletin 122, U. S. Bureau of Mines, Department of the Interior, Washington.

This discussion, by Dr. Edward Keller, of the entire question of sampling metals, is one that no one interested in the slightest degree in the subject can afford to be without. To it Dr. Keller brings the experience of many years in practical work, while it seems safe to say that no one has done more patient experimenting than he has on the underlying causes of differences in samples. Neither has anyone had a clearer view of the great truth that, however expert the chemist may be and no matter how refined his methods, the results will never be more accurate than is the sample that is given him.

About one-sixth of the contents of the book is given solely to theoretical considerations, the laws of solid solution, the formation of eutectics, etc. From this he passes on to the practicability of making homogeneous alloys, and to controlling the direction of diffusion, and to the sampling of what should be homogeneous alloys; that is, molten furnace charges, including doré bullion and pig iron.

Under the sampling of solid material are considered the effects of extraneous material and of segregation in all its phases. The final section deals with the practical side of work in the drill room. There are many illuminating tables and figures accompanying the text.

It would be impossible to review a publication of this sort fully without virtually reprinting it. This is unnecessary, as those who are interested will secure the pamphlet. However, in two specific subjects it should be pointed out that important papers in the early volumes of the "Journal" have not been given as references, and the seeker after information on these points should go to the original papers, where much more is given than the space limitations imposed upon Dr. Keller enabled him to get in his publication.

Thus, on the question of moisture in copper bullion, reference should be made to the "Engineering and Mining Journal" of Dec. 3, 1910, p. 1095. For the differences produced by drilling the same pigs from the top and from the bottom, to the "Journal" of Nov. 5, 1910, p. 897. These papers by Donald M. Liddell were, so far as our knowledge goes, the first on these subjects to be printed.

Personals

W. Earl Greenough, of Spokane, was in New York this week.

Corey C. Brayton will be at Midvale, Utah, through the month of June.

John Seward has returned to New York after a two-weeks' trip to Beatty and Munroe Townships, in Ontario.

Charles A. Randall started operations at the Holguin Exploration Co.'s cyanide plant, Holguin, Cuba, on May 15. The plant was built under his supervision.

Charles Whiting Baker, who recently resigned as editor-in-chief of "Engineering News-Record," has established offices as consulting engineer at 31 Nassau St., New York.

Hon. G. Howard Ferguson, Ontario Minister of Mines, has returned to his duties after a six weeks' trip to the West Indies and British Guiana much improved in health.

Clarence E. Whitney, president of the Whitney Manufacturing Co., Hartford, Conn., has been elected chairman of a citizens' committee engaged in patriotic work in Hartford.

J. R. Finlay, who has been absent for a long time on professional business in the West, expects to return to New York presently. He has removed his office to 45 Cedar Street.

Walter Alexander, Milwaukee, chairman of the Railroad Commission of Wisconsin, was recently appointed superintendent of motive power of the Chicago, Milwaukee & St. Paul railroad.

Prof. Robert S. Lewis, of the University of Utah, has returned to Salt Lake City after finishing a mine examination in Arizona. He will spend the summer at Huntington Lake, Calif.

John B. Wise, superintendent of the electrolytic and acid plant of the Chile Exploration Co., Chuquicamata, Chile, will be in the United States on his vacation from June 15 to Sept. 15 of this year.

Frank Glynn, mining engineer, representing the Guggenheim interests in Chile and other sections of the west coast of South America, arrived by steamer at San Francisco the last week in May.

Dr. A. W. Schorger, who for seven years has been connected with the Forest Products Laboratory, has resigned to take charge of organic chemistry with the C. F. Burgess Laboratories, at Madison.

Francis B. Coyle, metallurgist for the New Departure Manufacturing Co., Bristol, Conn., has resigned to assume new duties as metallurgical engineer for the Greenfield Tap and Die Corporation, Greenfield, Mass.

Guy N. Bjorge has resigned his position as mine geologist with the Old Dominion Copper Mining and Smelting Co., Globe, Ariz., to take up general mine-examination work. His address will be 27 State St., Boston, Mass.

F. A. Marriott and **W. B. Blyth,** both well known in mining circles, have formed a partnership and will accept consulting commissions as well as operate mines on their own account. Headquarters will be established at Bulawayo, Rhodesia.

George A. Easley, of La Paz, Bolivia, formerly manager of the Olla de Oro gold mine, but now devoting his attention to tungsten mining in Bolivia, is in the United States for a few months. His address will be Lee's Summit, Mo., while in the States.

S. C. Dickinson will assume the position of safety engineer with the Arizona State Bureau of Mines on July 1. This is the first time there has been a state safety engineer, and while the field of the position is comparatively new, its need has long been demonstrated.

C. A. Waring, field assistant of the California State Mining Bureau, visited Mother Lode counties in the latter part of May gathering data for the report to be made by the bureau on special minerals, including chrome, coal, iron, magnesite, manganese, molybdenum, quicksilver and tungsten.

Daniel Guggenheim, in an interview in New York, June 7, is quoted by the "Times" as saying: "I predict the end of the war before 1918 because, and only because, I have complete confidence in the determination and ability of the American people to carry on the war as they have started it, to fight with all of their might and not to stop fighting until German autocracy is no longer a menace to the world."

Howard C. Marmon, president of the Nordyke & Marmon Co., Indianapolis, Ind., manufacturers of automobiles and flour-milling machinery, has been appointed head of the motive-power branch of the military department which, heretofore a part of the Signal Corps, will be organized as a separate unit of the War Department. He will direct the manufacture of aëroplane motors in the United States, and has already been ordered to France on an inspection trip.

Rukard Hurd, director of the department of mines of the Minnesota tax commission, has received an appointment from President Wilson as a major in the Engineer Reserve Corps of the United States army. He will take an active part in the instruction camp at Fort Snelling this summer and will also assist in enlisting officers and men in the reserve corps. Major Hurd is a graduate in civil engineering from the Pennsylvania Military College. He organized and was captain of the Fourth Minnesota infantry in 1898. He is a member of the American Institute of Mining Engineers and other prominent technical societies.

Obituary

William Swancote, a pioneer of zinc mining in the Hanover, N. M., district, died at his home in Hanover on Apr. 17. A week previous to his death he had a severe fall, and later pneumonia set in, from which his death resulted. Mr. Swancote was born in Wales in 1844, but in the early 70's he located in Central City, Colo. In 1884 he came to New Mexico for the Mineral Point Zinc Co., for which company and its successor, the Empire Zinc Co., he was superintendent of mines until 1915. Mr. Swancote represented the highest type of manhood; he was an honor to his company and to mining. He will be mourned by the great company of which he was for so many years an important factor.

John C. Bridgman, a prominent resident and business man of Wilkes Barre, Penn., died on May 28, 1917. Mr. Bridgman had not been in good health for some time, having suffered from a nervous breakdown that occurred in the early winter. He spent several months at Clifton Springs, N. Y., and returned about six weeks ago greatly improved in health, and two weeks ago resumed his duties as manager of the Hazard Manufacturing Co. His sudden death occurred because of heart trouble. Mr. Bridgman was born at Northampton, Mass., 55 years ago, and went to Wilkes Barre about 30 years ago as one of the principals of the Harry Hillman Academy. In 1888 he resigned and became a sales agent for the Hazard Manufacturing Co., and later was promoted to the position of secretary. About 20 years ago he became general manager, and his efficient administration has made his company one of the foremost manufacturers of iron, steel and galvanized wire rope in this country. Mr. Bridgman was president of the Chamber of Commerce for one year, resigning on account of business duties. He was a member of Saint Stephens Episcopal Church, a Mason, and a member of the Westmoreland and Country Clubs. He is survived by his wife and twin sons, David Comstock and John Cloyes Bridgman; also by one brother, Walter Bridgman, of Lake Forest, Ill., and one sister, Mrs. W. S. Stedman, of Holyoke, Mass. We feel a keen loss in the untimely death of Mr. Bridgman. We regarded him as one of the leading authorities in the United States on the manufacture, properties and use of wire ropes. At a conference of the wire rope manufacturers and engineers of the United States in New York several years ago, at the invitation of the U. S. Bureau of Mines, to consider measures of safety in the use of wire ropes in mines (reported in U. S. B. M. Bull. 75), Mr. Bridgman made a profound impression by his exhibition of his knowledge of the subject, his lucidity of expression and his scientific analysis. We had been for a long time endeavoring to persuade Mr. Bridgman to give the readers of the "Journal" the benefit of his ideas through a series of papers and only a few weeks before his death he agreed to do so.

Societies

Institution of Mining Engineers, London, held its 66th general meeting at the rooms of the Geological Society, London, on June 15. On account of the war the usual dinner was omitted.

Mining and Metallurgical Society of America, New York Section, will hold a meeting at the Engineers' Club, New York, on Wednesday evening, June 20, 1917, which will be preceded by an informal dinner at 6.30 p.m. Further consideration of what the Mining and Metallurgical Society can do in the war will be the order of the evening.

American Institute of Mining Engineers, New York section, held a meeting on Wednesday evening, June 6, 1917, at which it was decided to continue the meetings of the section through the summer. This unusual course was taken to provide an opportunity for the members to learn of the problems of the Government so far as they are connected with mining and metallurgy, and to take an active part in solving them. All members of the section are urged to attend these meetings as a patriotic duty. The election of officers of the section resulted in the naming of J. E. Johnson, Jr., chairman, Edgar Rickard, vice chairman, D. M. Liddell, secretary, and C. A. Bohn, treasurer. A committee was appointed to draft suitable resolutions in regard to the death of David H. Browne, chairman of the section last year.

Colorado School of Mines held its forty-third annual commencement Friday, May 25, in Simon Guggenheim Hall, at Golden. T. A. Rickard delivered the address, "Mining, The Great Adventure." Twenty-seven graduates received the degree of Engineer of Mines, and the honorary degree of Engineer of Mines was conferred upon Hal W. Hardinge, once a student at the institution, and Walter Goodwin Swart. It is noteworthy that already seven of this year's graduating class are in the military service of the United States and seven others candidates for commissions in the Officers' Reserve Corps. On Saturday evening, May 26, the Alumni Association of the school held its annual banquet in Denver.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Chromium Oxide—Preparing Compounds of Chromium Oxide. Ernest Voetter, Krefeld, near Bockum, Germany. (U. S. No. 1,228,622; June 5, 1917.)

Dredging—Method and Apparatus for Reclaiming Dredged Land. Emery Oliver, Sacramento, Calif., assignor to Natomas Company of California, Natoma, Calif. (U. S. No. 1,228,959; June 5, 1917.)

Excavation — Drag-Bucket Apparatus. Alexander L. Hanot, Fairbanks, Alaska. (U. S. No. 1,228,554; June 5, 1917.)

Flotation — Apparatus for Recovering Precious Metals by Bucket Arrangement to Catch Float Gold. Charles R. Rawdon and Frank McCoole, St. Louis, Mo. (U. S. No. 1,228,133; June 5, 1917.)

Fuel-Regulating Device. George E. Lee, Cleveland, Ohio, assignor to The George E. Lee Company, Cleveland, Ohio. (U. S. No. 1,228,793; June 5, 1917.)

Furnace Ladle. James H. Griffin, Clay Center, Kan. (U. S. No. 1,228,665; June 5, 1917.)

Heat-Treating Furnace. Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio, assignors to The Electric Furnace Co., Alliance, Ohio. (U. S. No. 1,227,027; May 22, 1917.)

Lead Arsenate—Method of Making Lead Arsenate. Edwin O. Barstow and Joseph A. Cavanagh, Midland, Mich., assignors to Dow Chemical Company, Midland, Mich. (U. S. No. 1,228,516; June 5, 1917.)

Magnesium Carbonate—Process for Making Insulating Material from Basic Magnesium Carbonate and Fibrous Substances. Karl Schmid, Alt-Mugeln, near Mugeln, Leipzig, Germany, assignor to the Firm of "Lipsia" Chemische Fabrik, Actien-Gesellschaft, Mugeln, Leipzig, Germany. (U. S. No. 1,228,609; June 5, 1917.)

Melting-Pot Feeder. George L. Fort, Kansas City, Mo., assignor to Fort-ified Manufacturing Co., Kansas City, Mo. (U. S. No. 1,226,651; May 22, 1917.)

Mine Explosions—Means for Preventing Explosions in Mines. Audley Hart Stow, Maybeury, W. Va. (U. S. No. 1,228,985; June 5, 1917.)

Paint for Coating Metallic Surfaces Subject to High Temperatures. George E. Rieck, Bremerton, Wash. (U. S. No. 1,227,071; May 22, 1917.)

Retort Discharger. Georg Merkel, Munich, Germany. (U. S. No. 1,228,942; June 5, 1917.)

Settling Apparatus. Alfred L. Blomfield, Denver, Colo. (U. S. No. 1,227,107; May 22, 1917.)

Editorial Correspondence

SAN FRANCISCO—June 6

Committee on Dredge Safety Rules, during a three days' session in San Francisco at the offices of the California Industrial Accident Commission, made a careful survey of the rules prepared by Mr. Lowell, deputy mine inspector, and offered several suggestions which will be considered in the final meeting of the committee and probably written into the completed report to be submitted to the commission. The interest taken in this work equals that which lode-mine managers have shown. The men on this committee, as on other committees relating to the work of preventing accidents, are of the highest standing in the gold-dredging industry and are wholly competent to act with the inspectors in the preparation of the necessary rules for the guidance of dredge operators, not only in the digging of gold but in the reclamation of lands where the recovery of gold has no part in the operation.

Labor Strike at Yellow Aster Mine was settled by the arrest, conviction and banishment of a few Spanish labor agitators. For a time there was imminent danger of rioting that would have driven a number of peacable residents out of Randsburg and destroyed or at least impaired the fine reputation of the town and district. Randsburg has always been a busy, law abiding and prosperous gold-mining camp, made possible by the discovery, development and operation of the Yellow Aster mine. This pioneer mine and its owners and operators have put millions of dollars into circulation, provided labor for a large number of men and laid the foundation for the establishment of one of the greatest producing camps in the state and this in spite of the lack of water. On May 31, about 60 men quit the Yellow Aster, demanding $4 a day and within two days others joined them. Some of the strikers undertook to intimidate the men who remained on the job and for a day or so it looked serious. But the prompt action of the town and county officers and the assistance guaranteed them by the citizens put a stop to the row and put 40 of the strikers in jail. They were promptly and properly fined and the fines as promptly remitted, provided the defendants agreed to keep away from the Yellow Aster mine. Probably it did not occur to the better element of the miners who ultimately joined the strike that the price of tungsten might warrant increase in wages, as at Atolia, but the extra cost of operating a gold mine, without any increase in the price of the product, does not warrant gold miners in demanding extreme wage scales at this time.

DENVER—June 6

Roosevelt Drainage Tunnel was advanced 173 ft. in May, making the total length 23,500 ft. Water discharge is now about 6000 gal. per min. The breast is within the lines of the Old Ironsides claim of the United Gold Mines Co., where an immense dike is being cut. This rock is of fine-grained texture and is so thoroughly altered as to make its lithological classification difficult; it contains considerable pyrite and assays from $1.50 to $3 in gold. As soon as the tunnel passes through United Gold Mines territory and into the property of the Portland company, it will be driven towards a point under Portland No. 2 shaft, about 3000 ft. from the present breast. The original line of the tunnel had for its terminus the Golden Cycle shaft, 5000 ft. distant.

Smelter Investigation Committee began its first public hearing at Georgetown, Colo.; another hearing was held at Central City. Senator Fincher, who is chairman of the committee, announced that a series of hearings would be held throughout the state for the purpose of taking testimony under oath, the same as in court, and that all exhibits such as settlement sheets to illustrate the methods used by the smelters in the purchase of ore or other products would be gladly received. The chairman emphasized the fact that the committee desired to be as impartial as possible, and therefore would be interested in any testimony that would have a bearing on the problem in view, but could not be concerned with rumors or any statements that could not be proved. The committee desires to find out what the miners' grievances are, and then ascertain if the smelters are making an undue profit out of the producer. From the testimony received it is evident that the miners are strongly of the opinion that the smelters are taking far more from the ores than a fair and legitimate profit. The recent testimony indicates that 90% of the producers do not understand the present settlement methods. It appears that one way to satisfy the miners would be for the ore buyers to show on the settlement sheets the actual market value of the metals recovered from the ore, and show that a reasonable charge for smelting and refining has been deducted.

Advance in Compensation Insurance has been requested of the state industrial commission by Ralph Brann, local representative of the national Workmen's Compensation Service Bureau and of old-line insurance companies. An increase of 25% is asked. For the mine and mill operator this would mean an advance in the basic rate from $3.85 to $4.80 per $100 of pay roll. The request for the advance was granted, save as applying to the metal-mining industry. Officers of the Colorado Metal Mining Association requested that representatives of the industry from the various mining districts be heard before the commission took action on the matter. A meeting was held in the senate chamber of the capitol on May 19. Cripple Creek, Lake, San Juan, Boulder, Chaffee, Summit, Gilpin and other districts were represented by leading operators. Ralph Brann stated that recent changes in the law covering compensation insurance made the business unprofitable to old line companies, and that a 25% increase in the rates was almost a necessity. On the other hand, the mine operators pointed out that since the present rates were established the insurance carriers were, on account of the increased wages paid employees, receiving approximately 15% more for their services than demanded when the rates were fixed by the commission, less than two years ago. Furthermore, operators insured in the state fund had been informed by the commission that the present rates, which in the state fund are about 25% below that asked by the stock companies, not only provided for all losses and a surplus fund, but during the last year had returned a dividend of 23% of the premiums to the insured. Mining men, in the light of these facts, are at a loss to understand why any advance is necessary, especially as it is probable, so long as the war lasts, that wages will continue to advance, and in consequence the insurance carriers will be receiving more for the same service without any increase in their risk.

SALT LAKE CITY—June 7

Reductions in Insurance Rates for metalliferous and coal mines and for ore-reduction plants under the workmen's compensation law—tentatively set by the state industrial commission from figures received from the Workmen's Compensation Service Bureau—are recommended by L. L. Rubinow who, as already stated last week, has been visiting mining properties and studying the question, as actuary in the employ of the Utah Chapter of the American Mining Congress. He recommends $6.04 for coal mines for every $100 of payroll, instead of $9; $4.25 for metalliferous mines instead of $5.59, as well as a reduction for ore-reduction works, for which the proposed rate is $4.04. In regard to the rate for coal mines, the higher rate is placed for underground men, while the rate recommended by Mr. Rubinow is for all employees, it being suggested by him that the distinction would afford an opportunity for fraud on the part of employers in classifying employees. Letters to all employers of more than four employees call attention to the fact that insurance under the compensation act becomes effective July 1. General safety rules, formulated after consultation with the Manufacturers' Association of Utah, the Utah State Federation of Labor, the Insurance Federation of Utah, Utah Chapter of the American Mining Congress and the Master Builders' Exchange have been confirmed by the commission to become effective Aug. 1.

WALLACE, IDAHO—June 4

Private Support for Mine Station has lately been sought from Coeur d'Alene operators. Thomas Varley and C. A. Wright, representing the U. S. Bureau of Mines, have been spending some time in the district in conference with mine managers with a view to securing support for the experimental station which has recently been established at Moscow in connection with the state university. Private support is necessary owing to the fact that the appropriation made by the legislature was vetoed by Governor Alexander. They report the mining companies much interested in the work of the station and the necessary support will no doubt be forthcoming. Mr. Varley has charge of the ore-dressing experimental work of all the stations in the northwest and Mr. Wright, who comes from the Salt Lake station, will have charge of that department at the Moscow station. He will remain in this district for several weeks studying metallurgical problems at all the mills with the view to rendering practical assistance. He will visit at intervals all mining sections of the state, and it is hoped that the work of the station will accomplish much good in the way of lessening losses.

OATMAN, ARIZ.—June 6

Wage Scale Advanced June 1 in the Oatman district to approximate the wages of the copper camps with which this district has to compete for labor. The new scale provides a 50-c. increase per shift and the range of wages will be from $4 to $5.50 as follows: $4 per shift for common laborers, pick and shovel men, ore sorters, tailings-pond labor and what is known as the "bull gang;" hand miners, helpers of all kinds, tube-mill men, mill-pump men, crushermen and filter-press men will receive $4.50 per shift; hand miners in shafts, machine miners, timbermen, station pumpmen, batterymen, solution men, compressormen and refinery men $5 per shift; machine miners and timbermen in shafts, sinking-pump men, blacksmiths, timber-framers, machinists, electricians and hoisting engineers will receive $5.50 per shift. The wage scale submitted by the operators provides that these prices shall be paid as long as copper remains at 27c. per lb. or over, as quoted by the "Engineering and Mining Journal." When copper recedes 1c. per lb., wages are to be reduced 10c. per day all around, but electrolytic copper must sell at 22c. before the Oatman wages again reach the level paid prior to June 1. While this is a novel basis for fixing wages in a gold-mining camp, the operators hold that wages paid here and in the Arizona copper camps are correlated, and furthermore that the selling price of copper affords a fair index to living costs. No agreement has been signed by the men and the union has adopted the scale now being paid, without any provisions for an automatic reduction predicated on the fluctuations in the copper market. They assert, however, that if living costs generally resume former levels they will consent to a reduction in wages, as they realize that the gold mines are not benefiting by high prices, but are financially injured.

PHOENIX, ARIZ.—June 5

Arizona's Blue-Sky Law has not proved entirely effective in keeping down wildcat corporations. The Oatman district showed up scores of such companies, with assets of some ground, large promoters' claims and diminishing stockholders' hopes. The slump of at least one well-advertised mining enprise at Ray is a late occurrence. Most of the suspicion now seems to center around Jerome, where the great success of the United Verde Extension has caused the location of all the eastern face of the Black Hills and the issuance of much literature that "plays up" the United Verde and United Verde Extension. The Arizona Corporation Commission has taken notice of this state of things and has sent out a warning to prospective investors. It tells especially that issuance of permission to sell stock is far from being an indorsement by the commission of the corporation con-

cerned. No such indorsement ever is given or intended. The permit, which should be shown every person solicited to buy, gives in detail the plans of the company, a list of its property and a statement of its tangible assets. Permission to sell stock is given after an investigation into the affairs of the company and a stock-selling permit is issued if the commission is convinced that the plan of operation is fair and equitable. Suggestion has been made that a qualified inspector be named by the corporation commission to pass upon the financial plans of Arizona mining companies and to determine whether the development, or operation, of the properties involved is being done intelligently and honestly. It should be appreciated, however, that such an inspector would have powers that might make or break any mine in its earlier stages.

LEAD, S. D.—June 6

Homestake Pension System will go into effect on July 1, 1917. Employees, who through disability or old age have passed the period of usefulness, will be retired on 25% of their earnings and in addition will receive $10 per year for each year spent in the employ of the company. A person who has received $1000 per annum and worked for twenty years will receive an annual pension of $450. In no case will the sum allowed exceed $600 yearly nor must a person be in the employ of the company a fixed number of years to obtain a pension. On July 1, twenty-six employees will be retired on pension.

JOPLIN, MO.—June 9

Joplin Ore Producers' Association has been quietly reorganized. About a year ago this organization was formed and though much interest was recorded at the outset, nothing was accomplished. This time a few prominent local operators got together and instead of calling public meetings, held quiet meetings of their own and as a result the association is now in a fair way of accomplishing something. Approximately $750 per month has been subscribed monthly by producers and those in allied industries, and this will be expended in part for paying a secretary who will give his entire time to the work, and in part for collecting and using such data as will be considered valuable to the operators. Burt W. Lyon, of Joplin, head of the Lyon Investment Co., has been asked to assume the office of secretary and is expected to accept. The avowed purpose of the operators is not to antagonize the smelters or any other interest, but merely to do what can be done toward securing better prices for spelter. It is appreciated that the smelters cannot pay higher prices unless they receive a better price for their product.

TORONTO—June 9

Dome Mines Report for year ended Mar. 31, 1917, is now available, and shows that, while a serious over-estimate was made on the ore reserves for the year ended Mar. 31, 1916, which accounts for the decrease this year, diamond-drilling results were much above the ordinary. This work indicated extensions of the present bodies, and also encountered a new body of considerable size and apparently of good grade. Notwithstanding this encouraging feature, the report is a disappointment to shareholders, and they are entitled to a much fuller explanation than has been given.

Hollinger Dividend Will be Passed on June 18, according to an official statement just issued by Pres. N. A. Timmins. It is further stated that no more dividends will be paid for the present. The labor shortage and the inefficiency of the present force is given as the reason for this step. It is intimated that unless there is an improvement in the near future that milling will be suspended altogether and all work concentrated on development. It is known that the Hollinger has a large number of empty ore faces, and that a great deal of development and preparation will be necessary before the mine will be in a position to feed the increased mill which will shortly have a capacity of 3000 tons a day. Similar action on the part of the Dome management is foreshadowed in the annual report.

MELBOURNE—May 1

Bendigo Amalgamation Scheme has progressed to the extent that all the companies concerned have entered into the necessary agreement for merging their interests and the prospectus of the Bendigo Amalgamated Gold Fields (No Liability), is expected to be published at an early date. The new company will have a nominal capital of £500,000 in shares of 5s. each. Half of this capital will be distributed among the old companies and mine owners on a basis already laid down, and 400,000 shares will be offered to the public for subscription. The underwriters and promoters receive 200,000 fully paid shares. It is worthy of note that the mines comprised in this amalgamation have made an average net profit for the last 50 years of £100,000 per annum and the managing director has estimated that a profit of £70,000 per annum can be earned notwithstanding the increased cost of labor and commodities. The success of the Bendigo amalgamation plan has encouraged those interested in gold mining at Maldon, a one-time famous field, to consider a similar scheme. Maldon, however, does not offer anything so large in the way of undeveloped area as Bendigo.

Decreased Production of Gold in Australia continued in the first quarter of 1917. The decrease as compared with 1916 being approximately 40,000 oz. One reason is undoutedly the fact that mining does not receive the same encouragement at the hands of the government that its sister primary industry, agriculture, does. Mining, especially gold mining, is hit severely by import duties, taxation and wages awards. The lead and copper mines are benefiting from the high market prices for these metals and tin also is in a satisfactory position, but the development of the rarer metals, such as wolfram and molybdenite, has undoubtedly been retarded by the comparatively low rates which have been fixed by the government, namely: Wolfram, concentrated, 65%, 48s. 1d. at Melbourne or Sydney, and for molybdenite, 90%, 93s. 10d. at Melbourne or Sydney. These prices are much below the open market.

The Mining News

ALABAMA

Clay County

CARBON MOUNTAIN GRAPHITE (Lineville)—Organized by Kentucky men; will erect three plants, one on the Belle Haynes, one on the Isaac Watts, and on a third group near the Lineville Graphite Co. property. J. W. McCulloch, Owensboro, Ky., president; Owen Rutherford, superintendent; H. C. Hodges, superintendent of construction.

ALASKA

ALASKAN COAL FIELDS, according to a Washington dispatch, will be leased for 50-year period on royalty of 2c. per ton. Government expected to operate one area for use of its railroad.

KENNECOTT (Kennecott)—May copper production from the Alaskan properties was 7,208,000 lb., comparing with 7,180,000 lb. in April.

ARKANSAS

ORE SHIPMENTS from northern Arkansas in May amounted to 70 cars, 69 of which were of calamine, with a little blende, and 1 car of lead. The Rush camp was the biggest shipper, with 1,645,000 lb., and the Zinc district was next in order. The J. C. Shepherd Mining Co. was the largest individual producer.

NORTH STAR MINING (Yellville)—Constructing 50-ton mill, six miles north of Yellville. F. C. Heywood, superintendent.

GLORIA (Zinc)—This silicate mine producing three or four tons of 40% concentrates daily. R. J. Van and G. C. Hardin, operators.

J. C. SHEPHERD MINING (Rush)—Philadelphia 100-ton mill now treating ore from the Philadelphia, Monte Cristo and Leader mines.

CONFEDERATE (Cave Creek)—Building 400-ton mill. Crude-oil engines will provide power. C. Medley, superintendent; W. O. Krueger, manager.

CRAWFORD-ANSELL, LTD. (Mountain Home)—Completing 50-ton mill; will do openpit mining on Shiras Bros. and Johnson land; ore at 1½ to 6 ft. below surface.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—May production was: Copper, 1,385,669 lb.; lead, 233,119 lb.; silver, 23,141 oz.; gold, 156 oz.

Gila County

MIAMI (Miami)—Revised copper figures for May, 5,112,000 lb.; preliminary estimate of May output was 4,985,000 lb.

IRON CAP (Copper Hill)—April profits, $93,824; shipped 47 cars to El Paso smeltery and 32 cars of concentrating ore to Old Dominion mill.

INSPIRATION (Miami)—May production estimated at 11,900,000 lb., comparing with 11,400,000 lb. in April and in May, last year, 10,400,000 lb. Twenty sections of mill now running; maintained copper output at high mark, although at times during month ore is reported to have been under 1% copper.

Greenlee County

SHANNON (Clifton)—May copper output 964,000 lb., comparing with 924,000 in April.

Pima County

HELVETIA COPPER (Helvetia)—Has developed considerable tonnage of granular pyrite, carrying small amount of copper. Property 17 miles north of Vail and too low grade to ship profitably without railroad. Has been shipping ore from above water level, but shipments have been curtailed owing to expiration of smelting contract.

Yavapai County

WORK RESUMED AT JEROME, June 4, following settlement of strike. Gadsden Copper Co.'s men did not quit till June 1, owing to fact that May bonuses would have been forfeited if men had stopped before end of month. In some shafts, pumps were flooded and bailing is being done; water in Jerome Verde 1050-ft. shaft rose to the 426 level.

CALUMET & JEROME (Jerome)—Shaft now 500 ft. deep; station will be cut at 513 ft.

EMPRESS COPPER MINING (Wickenburg)—Have shipped four cars copper-gold ore from development work. Will sink old Swallow shaft to sulphide zone. C. K. Hartley, superintendent.

ARIZONA BINGHAMTON COPPER CO. (Stoddard)—This company has acquired Stoddard Mines Co. and Stoddard Milling Co. Present mill to be increased from 100 to 250 tons' daily capacity; ore treated runs about 5%. Orebody on 400-ft. level, about 100 ft. long, is being sought by crosscut on the 600 level.

SILVER LANE MINING (Crown King)—This old silver mine between Crown King and Tip Top reopened. Formerly penalized for zinc which it is proposed to separate in mill to be built on Humbug Creek if developments warrant. Working three shifts in driving 600-ft. tunnel. E. L. Riggs, superintendent.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—High-grade ore reported on 2600 level; extent of vein not yet determined.

KENNEDY (Jackson)—Orebody disclosed in crosscut on 3900 level, of good width and milling grade. Repairs to tailing dam completed and full 100 stamps again dropping.

VOLCANO GOLD GRAVEL MINING CO. (Volcano)—Dividend of 5c. per share declared. Property kept closed for 20 years by anti-debris law. Lately reopened and it is believed can now be operated in conformity to the law and made to pay.

DRYTOWN CONSOLIDATED MINING CO. (Drytown)—Permitted to issue 50,000 shares at 10c. per share to H. R. Moore,

G. C. Dickerman, J. W. Caldwell for money advanced and as part payment for Crown Point quartz mine and the Matulich land; and to sell 100,000 shares at 10c. per share for development purposes.

Butte County

TRIUMPH (Lumpkin) — Large duplex compressor and Denver rock drills being installed. Machinery hauled from Western Pacific Ry. station at Oroville to mine with motor trucks.

Calaveras County

CHILE GULCH near Mokelumne Hill is attracting attention of prospectors and miners by recent disclosure of 3-ft. ledge of decomposed quartz carrying free gold, which is being developed by B. Jackson, Lewis Ryan and George Edwards.

Kern County

PLATINUM reported by John W. Kelly and Edward Dooley, of Randsburg district, in the gulch near Fisher's old camp.

BUTTE (Randsburg)—Mine and mill both active. Most of ore comes from 215-ft. level.

WINDY (Randsburg)—Interests of John Singleton heirs acquired by P. Fahey, one of the owners; expects to have mine producing soon.

CONSOLIDATED (Randsburg)—Orebody reported disclosed in winze connecting 400 and 500 levels. Wedge shaft still produces water sufficient for the mill and furnishes water also to the Atolia mill.

Nevada County

REPUBLIC (Graniteville) — New 6-ft. Huntington mill being installed to supplement 10-stamp mill.

PORT ARTHUR (Washington)—Ore disclosed in crosscut from main tunnel at vertical depth of 250 ft.

Plumas County

BUNKER HILL (Quincy)—The Bulkeley Wells interests reported to be developing under option this drift property on Hopkins Creek, near Onion Valley. H. H. Ray is superintendent.

San Bernardino County

SCHEELITE (Atolia)—Operated under lease by John Jensen and Martin Metus.

ATOLIA (Atolia)—Experimental plant being installed for extraction of tungstic acid from high-grade tailings. E. C. Voorheis, manager.

OSDICK (Atolia)—Several leasers are working on this group of 13 claims situated southeast of the Atolia ground. Lackey & Henderson recently sold 1100 lb. at $19 per unit. Other leasers also taking out good ore.

Shasta County

MAMMOTH COPPER MINING (Kennett)—May copper output estimated at 2,000,000 lb.

DUKE (Igo)—W. H. Duke, owner, reports high-grade ore disclosed in crosscut tunnel at 200-ft. point. Ore refractory, as usual in this district.

GARDELLA (Redding) — Dredge construction delayed by inability to obtain lumber as fast as required. Lawrence Gardella, of Oroville, is owner and manager.

MOUNTAIN COPPER CO. (Keswick)—Surface men, including carpenters, machinists, railroad section men and others, who formerly worked 9 hours, have been put on 8-hour shifts, without reduction in pay. Miners have worked 8-hour shifts for several years.

Trinity County

PACIFIC GOLD DREDGING (Carrville)—Boulders said to be too heavy for 9-cu.ft. boat. Dredge will be removed to point 4 miles down stream on Coffee Creek.

TRINITY STAR (Lewiston)—Pit for dredge pond completed on Paulsen Ranch. Machinery hauled by team from Redding; 300,000 ft. of lumber and timbers sawed in district. Ranch one of finest in county; dredge will start digging in a lane between two afalfa fields growing in soil that covers gold-bearing gravel.

Tulare County .

REX PLASTER CO. (Porterville)—Loading chutes at Magnesite station destroyed by malicious explosion of dynamite on May 23. Believed that dynamite was fired by Austrian who had been dismissed from mine.

Tuolumne County

MUNN (Sonora)—Two shafts being sunk. Good showing of copper ore. Situated on Moccasin Creek. J. F. Munn, manager.

LITTLE WONDER (Sonora)—Good ore reported in 75-ft. shaft on Filipo Cavaleri Ranch ¾ mile from town; vein 6-ft. wide, sulphide ore. C. E. Rives and C. J. Heyler, of Los Angeles, are owners.

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—Recent underground development satisfactory. Construction on new refining plant at Boulder progressing rapidly: buildings nearly completed and foundations for much of the machinery laid; machinery on hand and is being installed. Chief product will probably be ferrotungsten.

MOJAVE-BOULDER TUNGSTEN CO. (Boulder)—This company, under leadership of G. F. Stringer, recently purchased Degge-Clark 40-ton concentrating mill in Boulder Canyon. Has been developing Bracken group of tungsten properties during last year with encouraging results. Body of payable ore opened in the April Fool property. Wire-rope tramway will be constructed from the Mojave property to main Boulder wagon road at Boulder Falls; from this point ore will be hauled by motor trucks to mill. Will continue custom business at mill, in addition to treating own ore. N. H. Brown, manager.

Clear Creek County

MENDOTA (Silver Plume)—Dump operations will be resumed under direction of William Buckley.

SMUGGLER (Silver Plume)—Being developed under A. E. Simpson. About 350 tons of ore per month shipped to Newton mill at Idaho Springs.

SHIVELY (Silver Plume)—Being developed by Pomeroy & Grenfell, lessees. High-grade silver-lead ore, carrying 350 oz. silver per ton, recently taken out.

LONE WOLF (Silver Plume)—Opened 6-in. vein of silver-lead ore assaying 126 oz. silver and 17% lead. Operations resumed on first and second levels of mine.

LUCANIA TUNNEL (Idaho Springs)—Contract let for 1100-ft. raise from tunnel to surface on the Pendleton property. New shaft house to be erected. L. Sternberger is manager.

NEW LIFE TUNNEL AND MINING (Idaho Springs)—New $1,000,000 corporation to develop Hoosac Tunnel Co. properties about two miles west of Idaho Springs. H. C. Perks is president and general manager.

Ouray County

GUSTON (Ironton)—Mine will be operated by leasing company; ore to be treated in Contention mill, which has been completely overhauled and flotation process installed.

WANAKAH (Ouray) — This company, which owns the Black Diamond and the Memphis properties, just below Ouray in the cliffs, reorganized by Syracuse, N. Y., men and development is planned. Company sold its interest in the smeltery at Ouray but retains the mill. Operations suspended about two years ago because of financial difficulties arising out of the smeltery purchase and operation.

Summit County

ORO EXTENSION (Breckenridge)—Unwatering shaft preparatory to resumption.

LEE (Breckenridge)—Fire recently destroyed new shaft house; will probably be rebuilt.

QUEEN OF THE WEST (Kokomo)—Sufficient stock sold to provide development fund. Good-grade ore being opened.

PITTSBURG PLACER (Breckenridge)—This ground in Illinois Gulch will be hydraulicked this summer. Preliminary work started.

GIBSON HILL MINING AND MILLING (Breckenridge)—Shoot of high-grade lead ore opened in raise from lower tunnel on New York group. Crew will be increased.

Teller County

FOREST QUEEN (Cripple Creek)—Shipments being made to Portland mill at Victor.

WILD HORSE (Cripple Creek)—Timbering at the 1100-ft. level being repaired preparatory to sinking. Shaft, now 1275 ft. deep, will be sunk 300 ft. I. J. Russell is superintendent.

WAR EAGLE (Cripple Creek)—Raise from 400-ft. level of Scott shaft, to connect with 300-ft. level of the Happy Year workings, has opened body of payable ore assaying from $10 to $15 a ton. Clayton Kissell, superintendent. Much development being done by lessees.

MODOC (Victor)—Shoot of ore, 400 ft. long, assaying $30, opened on lower level. Rapid progress being made with new vertical shaft which will be sunk to 1500-ft. level. Richard Roelofs, superintendent of Cresson mine, has been elected a director and Louis Noble, consulting engineer for Cresson, has been appointed to similar position with Modoc.

IDAHO

Shoshone County

STANLEY (Burke)—Shipping antimony-gold ore. Controlled by Hercules company. Main working tunnel of Hercules crosses Stanley ground, from which property is now being worked. Shipments made years ago from upper tunnels yielded good profit.

DREADNAUGHT (Wallace) — Exposed 3½-ft. vein of lead-zinc-copper ore; mine on upper Beaver Creek, within 1¼ mi. of railroad. Controlled by W. J. J. Smith, until recently superintendent of the Tamarack & Custer.

SUCCESS (Wallace)—Report for 1916 shows total income, $693,901; operating expenses, $471,862, leaving net profit, $222,039. Cash on hand first of year, $251,110. Seven dividends were paid aggregating $345,000. Cash surplus, $137,150. Shipping 2000 tons per month.

STEWART (Kellogg)—Federal's 500-ton mill at Wallace leased to treat ore from the Denver, on Pine Creek, which was recently acquired with the Nabob, a subsidiary of the Stewart. Company will build mill on Pine Creek if railroad is assured. If not, will build on Government Gulch and connect with tramway.

MICHIGAN

Copper

WINONA (Winona)—Working only No. 1 shaft because of lack of men.

TRIMOUNTAIN (Trimountain)—Installed three electric locomotives on lower levels. Increase in tonnage expected.

MAYFLOWER-OLD COLONY (Calumet)—Doing all necessary work preliminary to sinking shaft, such as building roads, erect-boiler and engine house.

SOUTH LAKE (Houghton)—Has now 16 drills in operation; 10 on development; two driving connection on sixth level for ventilation. Electric haulage under consideration. Producing 200 tons daily.

CALUMET & HECLA (Calumet)—Tonnage for May averaged almost 9600 tons. Mill expected soon to receive Tamarack ore. Foundations for doubling capacity of leaching plant completed; American Bridge Co. will erect building.

HANCOCK (Hancock)—Ordered another underground storage-battery locomotive. The two locomotives working on 18th level are to be transferred to the No. 7 Quincy shaft. Can now open more ground, especially at No. 2 shaft, through two winzes used as chutes.

MICHIGAN (Rockland)—In good ground on the Evergreen with good-sized shot copper; was out of the lode for a short time. Breaking rich rock at the Ogimah lode; here also lode was lost for a few feet. Raise from the sixth to the fifth level holed through, affording good ventilation. Three drills sinking from sixth level.

MISSOURI

MISSOURI COBALT CO. (Fredericktown)—Operating the old North American Lead Co. property. Ore comprises sulphides of copper, nickel, cobalt and lead disseminated through Cambrian limestone. Will treat 300 tons per day. Building mill and smelting plant. Prof. S. F. Kirkpatrick, consulting engineer; T. J. Mateer, general manager; H. Cox, superintendent of construction; R. F. Taylor, mine and mill superintendent.

Joplin District

HOUND DOG (Carthage)—To be reopened and mill will likely be rebuilt, after preliminary operation with smaller equipment. Paul Burklin, interested.

KELLY BROS. (Granby)—With J. R. Underwood, have completed new tailing mill on Goad mine. Third tailing mill in which Underwood is interested. Capacity 150 tons per shift.

LUCKY G. W. (Miami, Okla.)—Putting new drill rig, just purchased, on Lucky Jew tract. Drill rig on Lucky G. W. lease already has proved up ore and new mill will be built immediately. Alfred Hare, manager.

SCAMMON (Carthage)—Making car of ore every ten days from hand-jig plant on lease west of Carthage. Have crusher and rolls now installed and expect to build mill later. P. W. Moore, Scammon, Kan., manager.

CYGNI (Joplin)—Now milling 1000 tons per day; ore yielding about 2% blende. Three shafts being used and ore is taken out in one eight-hour shift, mill being run straight through. Mine at Prosperity, one of veteran sheet-ground producers. A. J. Burnham, Joplin, manager.

MONTANA

Lewis and Clark County

SCRATCH GRAVEL GOLD (Helena)—Stoping and drifting in gold-silver-lead ore at 500-ft. level. Shipments going to smeltery.

JULIA (Helena)—Kinks in shaft removed and sinking resumed at 180-ft. on incline. Ore to be stoped during progress of sinking.

CRUSE DEVELOPING CO. (Helena)—Drifting and stoping on 3 ft. of ore at 600-ft. level. Ore gold, silver and lead. Shipping to smeltery.

CARBON HILL (Helena)—Drifting at 300 level in big low-grade vein, with bunches of high-grade silver. May build mill at this Grass Valley property.

SPRING HILL (Helena)—Drilling campaign has shown large low-grade gold vein, estimated to average about $7 in gold. Negotiations pending with New York men.

VALLEY FORGE (Rimini)—Twenty-five carloads shipped to New York-Montana Ore Testing and Engineering plant at Helena during May. Samuel Mendenhall, superintendent.

ROCK ROSE (Helena)—Two distinct veins cut in drifting northeast from bottom of 200-ft. shaft. First one, 2 ft. of galena ore; second, chalcopyrite. Sinking resumed. Mine in Grass Valley section.

HELENA MINING BUREAU (Helena)—Shaft down 300 ft., in galena ore all the way from the 200-ft. station. Agreement calls for 300 ft. vertical depth. Shaft going down. When level is driven at the 300, ore will be stoped and shipped.

Silver Bow County

ELM ORLU (Butte)—Reported closed Monday night, June 11, by walkout said to be engineered by I. W. W. and Sinn Feiners. Anonymous circulars distributed over city demanding: Abolition of "rustling card" system; supervision of hiring of men; increase in wages; discharge of state mining inspector; restoration of right to hold public meetings, etc. Agitators trying to reorganize union.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ended June 2 was 9133 tons, valued at $169,071, comparing with 9493 tons for the previous week. Shippers were: Tonopah Belmont, 2454 tons; Tonopah Mining, 2100; Tonopah Extension, 2380; Jim Butler, 750; West End, 1018; Rescue, 190; Montana, 46; Cash Boy, 100; North Star, 52; miscellaneous, 53 tons.

MANHATTAN WAR EAGLE (Manhattan)—This 20-stamp mill is treating ore from the Jumping Jack Mining Co. Four trucks busy hauling ore.

MANHATTAN MORNING GLORY (Manhattan)—Shaft now 125 ft. deep; bottom showing stringers of calcite with some stibnite and realgar. Work continuing in old lease shaft and at open cut near White Caps west line. Six-drill compressor purchased from Silver Peak company has arrived.

WHITE CAPS (Manhattan)—Shaft sinking has progressed to 85 ft. below fourth level. Cement bulkhead being installed on third level east drift, after which work will be resumed in both east and west drift. New 50-hp. motor will operate the 6 x 8-in. triplex pump on fourth level. Two hearths of Wedge roaster completed and roll building has been housed in.

Storey County

JACKET (Gold Hill)—Repairs to shaft and incline. Saved 93 cars of ore from tunnel workings.

UNION (Virginia)—On 2500 level extracted 101 tons of ore. Prospected on 2300 and 2400. Reopening north drift in west crosscut 326 ft. from 2500-2900 winze.

SIERRA NEVADA (Virginia)—From 2450 level extracted 116 cars of ore sampling $14.67 per ton; from 2500-level prospecting, 10 cars averaging $7.35 per ton.

CON. VIRGINIA (Virginia)—Southwest drift 2700 level advanced to 220-ft. point; extracted 50 cars of ore averaging $18.37 per ton; from floor above sill saved 69 mine cars of ore averaging $16.72 per ton.

MEXICAN (Virginia)—Mill received 263 tons of ore from Wedge dump, assaying $5.49; 5 cars sampling $21.10 per ton, 6 cars sampling $10.17 per ton from 2700 level; 101 tons Union ore averaging $12.63; 264 tons Sierra Nevada, sampling $10.27.

NEW MEXICO

Grant County

PROGRESS MINING (Steeplerock)—Shaft sunk to 215 ft.; crosscut from 200-ft. level has progressed 118 ft.; in vein matter 26 ft. without footwall but material is not of commercial grade, though some seams of good ore were passed through before cutting present fissure. Company plans to sink to 1000 ft. Charles F. Hanson, manager.

SOUTH DAKOTA

Lawrence County

ST. ANTHONY (Galena)—Kitmass & Gunn, leasers have shipped their first car of lead-silver ore to the smeltery in Colorado. Regular production will follow.

HOMESTAKE (Lead)—One car of tungsten concentrates were shipped recently to Pennsylvania and additional shipments making total of 90 tons will be sent immediately. Most of the old dumps which have supplied mill heretofore have been treated and ore is now taken from mine, where large supply has been blocked out.

UTAH

Beaver County

PALOMA GOLD AND SILVER (Milford)—Development being done in promising ground. M. P. Braffet, president.

CREOLE COPPER (Milford)—Expects to ship regularly copper ore worth about $23 a ton. Four cars shipped recently.

MOSCOW (Milford)—Drift on 1400 level nearing ground below oreshoot opened on 1100. Accumulated zinc-sulphide ore being shipped.

UNEVIDA GOLD MINING CO. (25 Broad St., New York)—This $7,500,000 company, organized by W. C. Ralston, to work the old Sheep Rock gold mine near Beaver, Utah; placers in Cariboo district about 30 miles north of Soda Springs, Idaho; 4000 acres near Copper Canyon, southwest of Battle Mountain, Nev., and the bed of the Carson River below the old Comstock mills. After repairing old workings of the Sheep Rock mine, and developing, a 100-ton preliminary milling unit will be built to handle the ore estimated to average $8 per ton. The placers will be worked by dragline and the gravels washed in special shaking sluices; Carson River bed, however, is to be worked by hand for recovery of amalgam from old mills, after diverting river. The officers and directors are: President, A. B. Lewis of Beaver, Utah; vice president, E. F. Cragin of New York; secretary, W. C. Ralston of New York and San Francisco; treasurer, W. S. McCornick of Salt Lake City; other directors are N. M. Hamilton and Frederick Steigmeyer of Salt Lake City; H. J. Casady and Charles C. Shedd of Chicago; two or three other directors will be added from Boston, one of whom will probably be George H. Morrill.

Salt Lake County

OHIO COPPER (Bingham)—Company reported to be making from $30,000 up to $80,000 monthly, the new flotation section contributing to the earnings.

UTAH COPPER (Bingham)—First assessment of $6,125,000, made by county commissioners, on Bingham & Garfield Ry. reduced to $5,888,000; this, however, is an increase of $1,888,000 over assessment for 1916.

Summit County

BIG FOUR EXPLORATION (Park City)—Mill treating 500 tons daily; estimated profit, $10,000 monthly. In two weeks expected to reach 900 tons a day.

THREE KINGS (Park City)—New equipment installed, and sinking of winze toward contact resumed. Down 180 ft., and objective point 50 ft. further. Work to be started along surface 350 ft. from shaft to develop outcrop.

WASHINGTON

Lincoln County

WESTERN TALC (Everett)—Company has begun opening by tunnel a talc deposit north of Reardan. Will begin milling this summer.

Stevens County

FRISCO-STANDARD (Northport)—This mine, about four miles north of the Electric Point mine, has cut 7-ft. vein at 155-ft. depth; contains 1 ft. of shipping-grade silver-copper ore.

CANADA

Ontario

SYLVANITE (Kirkland Lake)—Operations suspended. Some good veins cut in underground work shortly before closing down.

MURRAY-MOGRIDGE (Wolf Lake)—Shaft down nearly 100 ft., vein maintaining good milling grade. New steam plant in operation.

DAVIDSON (Porcupine)—Diamond drilling, started from 300-ft. level, encountered at depth of 135 ft., a 32-ft. orebody, showing free gold.

McINTYRE (Porcupine)—In May mined 15,064 tons of ore averaging $9.83. New hoist with capacity for 2000 ft. installed at Jupiter shaft.

TOUGH OAKES (Kirkland Lake)—Treating 120 tons a day but, like other gold mines in the north country, is suffering from shortage of labor.

TRETHEWEY (Cobalt)—Representative of this company is in Tashota sampling group of claims, ore from which will be brought to Cobalt for treatment.

PETERSON LAKE (Cobalt)—Injunction granted this company restraining Dominion Reduction Co. from taking mill tailings out of Peterson Lake has been lifted. Dominion Reduction proposes to treat these tailings by flotation.

KIRKLAND LAKE (Kirkland Lake)—About 4000 tons of milling-grade ore on dump taken out in development. Drift at 400-ft. level advanced 425 ft. west; good ore in face. At 600-ft. level, two drifts being run, one on each wall of the orebody, in high-grade ore; intervening body, 30 ft. wide, fair milling ore.

Quebec

MONTABAUN AND LAURENTIDE zinc properties, in the Notre Dame des Anges district, have been optioned by an American syndicate, represented by E. F. B. Daude of New York; development on both properties and completion of the mill on the Montabaun mine is planned. The only other zinc mine now producing in the district is that owned by the Weedon Mining Co. of Weedon. This company is concentrating at the mine, using flotation and hauling the concentrates to the station about eight miles where they are beneficiated by magnetic treatment. Zinc and lead concentrates are produced. The lead product contains some silver. A small plant for the conversion of the zinc product into oxide is installed at Notre Dame and an experimental run has been made. This plant is not running now because the high price obtainable for the zinc ore makes shipment more profitable.

MEXICO

GREENE-CANANEA (Cananea, Son.)—Production in May was: Copper, 4,370,000 lb.; silver, 153,186 oz.; gold, 1025 oz. April copper output, 4,730,000 lb.; May, last year, 5,948,000 pounds.

AMERICAN METAL CO. (61 Broadway, New York)—This company and its subsidiary, Cia. Minerales y Metales, are acquiring additional properties in Mexico, latest acquisition being the San Toy silver-lead mine in Santa Eulalia district, Chihuahua, formerly controlled by Donald B. Gillies, Charles M. Schwab and associates.

NICARAGUA

PETROLEUM CONCESSION, giving exclusive right to prospect and develop Nicaraguan fields, to Lincoln G. Valentine, nephew of Washington S. Valentine of 17 Battery Place, New York, approved by President Chamorro on June 8 and will soon be acted upon by Nicaraguan congress. Geologists have been in the field for some time; good indications reported on both Atlantic and Pacific coasts.

PERU

CERRO DE PASCO (La Fundicion)—May copper output 4,670,000 lb., a decrease of 1,266,000 lb. from the April production. Due to strike.

CHILE

NITRATE PRODUCTION for first quarter of 1917 reported as 15,792,036 Spanish quintals (101.4 lb.), comparing with 16,390,926 in 1916; exports were 13,773,434 quintals in first quarter of 1917 as against 15,088,267 quintals in 1916.

BRADEN (Sewell)—May copper output 6,750,000 lb., as compared with 5,102,000 lb. in April. May, last year, 3,882,000 lb.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Elisabethville)—May copper production was 5,643,775 lb.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable report, May cleanup $115,330. April bullion amounted to $125,601, divided as follows: Tabowie mill, $26,738; Taracol, $26,107; Maibong, $18,523; Taracol cyanide plant, $50,873; Maibong tube-mill plant bullion, $3360. Milled in April, 26,451 tons. March net profits were $74,238. Hydro-electric plant started again on Apr. 22. During last half of April company planted 100,000 three-year-old larch and pine trees; local governmental authorities planted 60,000 young mulberry and chestnut trees donated to the Unsan district by the company.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	June	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
7	4.7550	75⅜	38½	11	4.7550	76⅜	38⅞
8	4.7550	75⅜	38⅜	12	4.7550	77	39 1/16
9	4.7550	75¼	38 1/16	13	4.7545	77	39 1/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
	29⅜		10⅛	10⅛	9¼
7	@30⅜	60¾	@11	@11	@9½
	29⅜		10⅛	10⅛	9¼
8	@30⅜	61	@11¼	@11¼	@9½
	29⅜		11	11	9¼
9	@30⅜	61	@11⅜	@11⅜	@9½
	30		11	11	9¼
11	@31	60¾	@11¼	@11¼	@9½
	30		11	11	9¼
12	@31	60¾	@12	@12	@9½
	30		11	11	9¼
13	@31	60¾	@12	@12	@9½

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

June	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos.	Lead: Spot	Zinc: Spot
7	130	130	142	238½	236½	30½	54
8	130	129½	142	238½	236½	30½	54
9	....	....	....	....	....	....	....
11	130	129½	142	236½	233½	30½	54
12	130	129½	142	236	233½	30½	54
13	130	129½	142	236½	234	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

NEW YORK—June 13, 1917

The metal markets this week continued very strong, but uncertainty respecting Government requirements, arrangements, etc., became an increasingly irritating factor. Negotiations with the several committees are going on, but nobody seems able to bring them to any conclusion. The public ought to know what are the reasons that are causing the delays. Attention should be directed to high quarters. Why is it that Government departments should be asking for needed copper supplies to be booked at provisional prices, subject to adjustment later? And why is it that while the director of raw material supply is conferring with the committees of lead producers, the Frankford Arsenal should be allowed to ask on its own hook on June 11 for tenders for 150 tons of lead?

Copper, Tin, Lead and Zinc

Copper—A pretty good business was done on June 7 and 8, especially with wire drawers, but following that the market became less active, although on Monday and Tuesday a few round lots were sold. The bulk of the business was for third-quarter and August-October delivery, especially August-October, which is now regarded as the major market. However, it is noteworthy that considerably more far-forward business was done than in previous weeks, there having been one large sale covering deliveries from October to March, and another large one for October-February. We estimate sales of electrolytic copper as having amounted to about 16 million pounds in the aggregate, which was a little more than in the previous week.

As to prices, spot and June copper is variously quoted at 33@35c. June is reputed to have sold in trifling quantities as high as 35c. Small business in July copper, which is now very scarce, was done at 32c., r.t. At the close, July was quoted at 31½@32c.; August at 31c.; September, at 30@30½c.; October, at about 30c.; November, at 29½c.; and December, at 29c.; all regular terms. Late in the week an inquiry for 5,000,000 lb. for August-October was in the market. Offers to take that business were made at 30¾c., r.t., but so far as we can learn, the business was not placed. On an inquiry for a round lot of July-September copper, sellers offered to supply it at 31c., r.t., but the buyer alleged that he could get it for less, which, however, was very doubtful. The far-forward business was done at prices of 28@29c., net cash, New York.

Copper Sheets—The price of copper sheets continues at the same figure as noted last week. We quote hot rolled at 38c. per lb., cold rolled 1c. higher. Wire now quoted 34@36c. f.o.b. mill.

Tin—This market was as small as could be and have any market at all. Fluctuations in price were insignificant. The most interesting feature was the sharp decline in Banka tin, which sold at 55¾c. on June 8, when Straits was fetching 61c. This was due to the large quantity of that class of tin on hand and the efforts of holders to find a market. At the close of the week the price for Banka tin had rallied to 57½c. Negotiations between the tin interests and the Governments are still going on.

Lead—A fairly large business was done, reported sales by producers amounting to upward of 2500 tons. On June 8 the A. S. & R. Co. advanced its price to 11c. and sales of June lead by several producers were made on that day at 11c. However, the advances by the A. S. & R. Co. simply furnish a new step from which the market in uncontracted lead climbs higher. At the close, June lead was offered at 12c., and July, at 11¾c., but sales at those prices were light. The average of the market, broadly considered, is not over 11½c. An interesting feature of the week was the sale of a tonnage of August-December delivery at a price closely approximating that prevailing for July lead. A further tonnage was offered at about the same price. One encouraging feature in the lead market is the increasing production of Mexico, which has now attained a rate of about 6200 tons per month, which is much in excess of what it was three months ago. Some new production is expected from Missouri and may begin to materialize in July, but there have been so many disappointments about this that expectations are now talked about with caution.

Zinc—This market continued dull and uninteresting. There was again some speculative buying, but on the whole, transactions were relatively light. In the latter part of the week there were sellers of all positions at 9¼c., while supplies of prompt spelter might be obtained at 9¼c. by doing a little shopping. A consumer claimed that he could buy high-grade spelter at 13c. There were sellers of intermediate at 12c. and business was done in brass special at 10c. for near-by and 10@10¼c. for futures.

Zinc dust is quoted at 16@17c. per lb.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market continues quiet and devoid of any features of special interest. Quotations continue at about the same level. 59@61c. per lb. for No. 1 ingots at New York.

Antimony—This market was dull and weaker even than in the previous week. Small sales of spot were made at 19½c., which we quote. We quote July shipment from China at 15@15½c., c.i.f. New York, duty unpaid.

Bismuth—Quoted at $3 per lb.

Cadmium—Quoted at $1.50 per lb.

Cobalt—Quoted at $1.70 per lb.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Quicksilver—Weak at $85, with little business reported. San Francisco reports, by telegraph, $87½.

Gold, Silver and Platinum

Gold—The Bank of England gold reserve against its note issue, according to a report from Samuel Montagu & Co., under date of May 24, shows an increase of £174,990 as compared with the previous week.

Silver—Market continues firm, owing chiefly to the demand for India, as has been previously reported. The shipments for the Orient have been going forward, mostly via San Francisco instead of by London, owing to the differential in war rates, insurance being much less on the Pacific than the Atlantic. The price for the past week has shown an advancing tendency.

Mexican dollars at New York, June 6, 58½c.; 7, 58½c.; 8, 58⅝c.; 9, 58⅝c.; 11, 59½c.; 12, 59¼c.

Platinum—We quote this market unchanged at $105.

Palladium—This metal was stronger on increased inquiries. We quote $105@108.

Zinc and Lead Ore Markets

Platteville, Wis., June 9—Blende, basis 60% Zn, $78 for premium ore down to $72 for medium grade. Lead ore, basis 80% Pb, $130 per ton. Shipments for the week are 2613 tons of zinc ore, 121 tons of lead ore, and 475 tons of sulphur ore. For the year to date the figures are: 60,716 tons of zinc ore, 2572 tons of lead ore, and 11,612 tons of sulphur ore. Shipped during the week to separating plants, 3037 tons of zinc ore. Shipments were impaired by almost continuous rain.

Joplin, Mo., June 9—Blende per ton, high $81.90; basis 60% Zn, premium ore $80; medium to low, $76@70; calamine per ton, basis 40% Zn, $45@40; average selling price all grades of zinc, $71.31 per ton. Lead, high, $130; basis 80% Pb, $130@125; average selling price, all grades of lead, $123.50 per ton.

Shipments the week—Blende 10,399 tons, calamine, 640 tons; lead, 1673 tons. Value, all ores the week, $990,240.

Henryetta, Oklahoma, was tornado swept last night and meagre news received from there indicate that the Nicholson smeltery is seriously dismantled, the Eagle-Picher lost several stacks and one roasting furnace, while the Henryetta company suffered less damage. Strikers continue to prevent the operation of the works of the Fort Smith Smelting Co. at Fort Smith, Arkansas, and fears are entertained that the fever may spread among other smelters.

Other Ores

Antimony Ore—Remains substantially unchanged. There were buyers at $2.30 per unit.

Iron Ore—Prices, delivered lower Lake ports, old-range bessemer, $5.95; Mesabi bessemer, $5.70; old-range non-bessemer, $5.20; Mesabi non-bessemer, $5.05.

Manganese Ore—Continues firm, $1 per unit being paid for ore of 49%.

Molybdenum Ore—Unchanged at $2.20 per lb. of molybdenum sulphide in molybdenite assaying 90%. Market firm.

Pyrites—Market remains in the same condition as quoted last week. Domestic supply is practically all contracted. Spanish ore, furnace size, 15½c. per unit, on basis of 10s. freight, buyer paying war risk and excess freight. Domestic fines, 10@10½c.

Tungsten Ore—Extremely firm, with very little offered. We quote the best grades of ore at $20 per unit.

Iron Trade Review

NEW YORK—June 13

The scramble for steel-making pig iron and for melting steel scrap has gone on for another week, says "Iron Age," with no abatement of the excited conditions. Bessemer pig iron has advanced to $55 on small sales and its further ascent presents no difficulties. Basic iron on sales of more than 50,000 tons at $50 at Valley furnace, has been lifted $5 a ton, while forge iron is $3 higher and foundry iron $5 higher in Pittsburgh and Cleveland markets. Melting scrap has sold at $42.50 in the Pittsburgh district, representing $12.50 advance in two weeks.

PITTSBURGH—June 12

The apparent famine in pig iron and scrap is the oustanding feature of the iron and steel market situation. Bessemer pig iron sold at $45, valley, about May 20, reached $50 on May 29 and sold at $55 late last week, basic iron rising with equal rapidity. Heavy melting steel scrap, which barely more than a fortnight ago had risen to $30, delivered Pittsburgh, began to be bid for at $40 last Thursday, the Carnegie Steel Co. accepting all offers, while at least two other steel interests paid the same price. The situation appears to be one of there not being enough pig iron and scrap to keep in operation all the steel-making capacity, arising from the large increase in steel-making capacity of late, the restriction in pig-iron output due to coke shortage and the decreased production of scrap owing to less shell steel, with its heavy discards, being made. It is a possibility that pig iron and scrap will reach a level equal to the value of steel minus the cost of conversion, which would mean a further rise of $25 or more.

Buying of steel for war purposes is not very active as it requires more time than was expected to formulate definite orders. Steel for shipyard equipment and for shipbuilding is being shipped in large tonnages, however.

Steel prices are very irregular, so much depending on tonnage, delivery, and the standing of the would-be buyer, approximately 7@8c. for tank plate, 4.25@4.50c. for shapes, 3.75@4.25c. for bars, 7.50@8c. for black and blue annealed sheets and $3.50@3.75 for nails.

Pig Iron—Since last report, noting sales of 19,000 tons of bessemer at the advanced level of $50, valley, about 15,000 tons more was sold at the price and then there were sales of limited tonnages at $53, followed by 1000 tons at $55, which is held to be the minimum now. Basic, which had gone up $3 to $45, is now $50, and foundry and malleable are also quotable at that figure, with scarcely any sellers, irrespective of price. Inquiry is fairly large, and chiefly for first half 1918, while in an exceptional case a bid of $50 for 6000 tons of bessemer a month over the whole year 1918 has been made, and turned down.

Steel—Offerings are very limited. Steel made to regular specifications would command $90@100 for billets and $105@110 for sheet bars, but odd lots accumulated might possibly go for less. The mills do not quote for forward deliveries.

Iron Ore

Iron Ore—Shipments down the lakes in May were 6,283,612 tons, or 1,165,968 tons less than in May, 1916, making the total to June 1 6,495,144 tons, or 3,912,847 tons less than to June 1, 1916, due entirely to late ice on Lake Superior. There is new vessel capacity, however, and part, if not all of the shortage can be made up, while it is probable that the furnaces could get through to the 1918 shipping season with less than was moved last year. The canvass just completed of individual furnaces has not proved encouraging, but the furnaces probably estimated their requirements on a liberal scale.

STOCK QUOTATIONS

N. Y. EXCH.†	June 12
Alaska Gold M.	5½
Alaska Juneau	4½
Am.Sm.& Ref.,com.	108½
Am. Sm. & Ref., pf.	113½
Am. Sm. Sec., pf. A	101½
Am. Sm. Sec., pf. B	93
Am. Zinc	33½
Am. Zinc, pf.	63
Anaconda	84⅛
Batopilas Min.	1
Bethlehem Steel	155¾
Bethlehem Steel, pf.	‡120
Butte & Superior	45½
Cerro de Pasco	36
Chile Cop.	22½
Chino	60½
Colo.Fuel & Iron	53½
Crucible Steel	80½
Dome Mines	10
Federal M. & S.	15
Federal M. & S., pf.	43½
Great Nor., ore ctf.	33½
Greene Cananea	45
Gulf States Steel	127
Homestake	100
Inspiration Con.	65
International Nickel	41½
Kennecott	47½
Lackawanna Steel	101½
Miami Copper	41½
Nat'l Lead, com.	57
National Lead, pf.	108
Nev. Consol.	25⅞
Ontario Min.	5½
Quicksilver	1½
Quicksilver, pf.	1⅝
Ray Con.	30½
RepublicI.&S.,com.	91½
Republic I. & S. pf.	105½
Sloss-Sheffield	59½
Tennessee C. & C.	16½
U. S. Steel, com.	130⅛
U. S. Steel, pf.	117
Utah Copper	116½
Va. Iron C. & C.	69

N. Y. CURB†	June 12
Big Ledge	3
Butte & N. Y.	1½
Butte C. & Z.	12⅞
Caledonia	.57
Calumet & Jerome	1½
Can. Cop. Corpn	2½
Carlisle	‡5
Con. Ariz. Sm	2⅜
Con. Coppermines	6¼
Con. Nev.-Utah	.09
Emma Con.	1½
First Nat. Cop.	2½
Goldfield Con.	.54
Goldfield Merger	.07
Greenmonster	1
Hecla Min.	8⅜
Howe Sound	5½
Jerome Verde	1½
Joplin Ore & Spel.	.15
Kerr Lake	4½
Magma	.46
Majestic	.45
McKinley-Dar-Sa.	.50
Mohican	.75
Mother Lode	.28
N. Y. & Hond.	14½
Nipissing Mines	7⅜
Ohio Cop.	1½
Ray Hercules	4
Rochester Mines	.53
St. Joseph Lead	18½
Seneca	10½
Standard S. L.	.40½
Stewart	.28½
Success	.39
Tonopah	6⅞
Tonopah Ex.	2⅜
Tribullion	⅞
Troy Arizona	.27
United Cop.	¼
United Verde Ext.	39½
United Zinc	4½
White Knob, pf.	1½
White Oaks	‡2
Yukon Gold	1½

SAN FRAN.*	June 12
Alta	.03
Andes	.07
Best & Belcher	.04
Bullion	.02
Caledonia	.11
Challenge Con.	.01
Confidence	.10
Con. Virginia	.24
Gould & Curry	.02
Hale & Norcross	.04
Jacket-Cr. Pt.	.03
Mexican	.13
Occidental	.65
Ophir	.11
Overman	.04
Savage	.09
Seg Belcher	.02
Sierra Nevada	.07
Union Con.	.20
Utah Con.	.01
Belmont	4.00
Jim Butler	.70
MacNamara	.25
Midway	.11
Mont.-Tonopah	.19
North Star	.10
Rescue Eula	.24
West End Con.	.65
Atlanta	.11
Booth	.08
Comb. Frac.	.04
D'field Daisy	.03
Florence	.18
Jumbo Extension	.37
Kewanas	.14
Nevada Hills	.25
Nevada Packard	.34
Round Mountain	.39
Silver Pick	.11
White Caps	1.37½
Big Jim	.75
Nellie	‡.15½
Tom Reed	‡1.93½
United Eastern	4.50

BOSTON EXCH.*	June 12
Adventure	3
Ahmeek	105
Algomah	.60
Allouez	65½
Ariz. Com., ctfs.	14½
Arnold	.30
Bonanza	.21
Butte-Ballaklava	.60
Calumet & Ariz.	80½
Calumet & Hecla	530
Centennial	18
Copper Range	61½
Daly West	1½
Davis-Daly	6½
East Butte	13
Franklin	7
Granby	85
Hancock	14
Hedley	15
Helvetia	.40
Indiana	2½
Island Cr'k, com.	71
Isle Royale	31
Keweenaw	1½
Lake	13
La Salle	3½
Mason Va'ley	5½
Mass.	13
Mayflower	2½
Michigan	3
Mohawk	90
New Arcadian	3
New Idria	15
North Butte	19½
North Lake	1½
Ojibway	1
Old Dominion	63½
Osceola	88½
Quincy	86½
St. Mary's M. L.	81
Santa Fe	1⅛
Shannon	8¼
Shattuck-Ariz.	26
So. Lake	3½
So. Utah	‡.18
Superior	9
Superior & Bost.	5
Trinity	4½
Tuolumne	1½
U. S. Smelting	61
U. S. Smelt'g, pf.	50½
Utah Apex	2½
Utah Con.	16½
Utah Metal	4½
Victoria	4½
Winona	3
Wolverine	44
Wyandot	.90

BOSTON CURB*	June 12
Alaska Mines Corp.	.75⅞
Bingham Mines	12½
Boston Ely	.55
Boston & Mont.	.62
Butte & Lon'n Dev.	.18
Calaveras	3½
Calumet-Corbin	.01½
Chief Con.	.2 2½
Cortez	.20
Crown Reserve	.25
Crystal Cop	1⅛
Eagle & Blue Bell	.2½
Houghton Copper	.90
Intermountain	1
Iron Cap, ccm	19
Iron Cap Cop., pf.	18½
Mexican Metals	.28
Mines of America	1½
Mojave Tungsten	.43
Nat. Zinc & Lead	.60
Nevada-Douglas	1½
New Baltic	1½
New Cornelia	17½
Oneco	.50
Pacific Mines	.25
Rex Cons.	.27

SALT LAKE*	June 12
Bannack	1.00
Big Four	.54
Black Jack	.06
Cardiff	7.00
Colorado Mining	.17
Daly-Judge	8.50
Empire Copper	1.25
Gold Chain	.11
Grand Central	.45
Grand Gulch	.19
Iron Blossom	1.05
Lower Mammoth	.03
May Day	.08½
Moscow	.12
Prince Con.	1.25
Silver-King Coal'n	3.12½
Silver King Con.	3.82½
Sioux Con.	10½
So. Hecla	1.05
Uncle Sam	.02½
Wilbert	.14
Yankee	.11

TORONTO*	June 12
Bailey	.03
Beaver Con.	.32
Buffalo Mines	.95
Chambers Ferland	.10
Conmagas	3.75
La Rose	.37
Peterson Lake	.08½
Right of Way	.04
T. & Hudson Bay	38.00
Temiskaming	.36
Wettlaufer-Lor.	.05
Dome Exten.	.13
Dome Lake	.17
Foley O'Brien	.70
Hollinger	3.40
Jupiter	.28
McIntyre	1.35
Newray	.60
Porcu. Crown	.56
Schumacher	.45
Vipond	.53
West Dome	.18

STOCK QUOTATIONS—Continued

COLO. SPRINGS	June 12
Cresson Con.	5.12½
Doctor Jack Pot	.05½
Elkton Con.	.06½
El Paso	.30
Gold Sovereign	.04
Golden Cycle	2.21
Granite	.52
Isabella	.10½
Mary McKinney	.20
Portland	1.48
United Gold M.	.18
Vindicator	.75

LONDON	May 25		
Alaska Mexican	£0	10s	0d
Alaska Tre'dwell	1	15	0
Burma Corp.	4	0	0
Cam & Motor	0	9	0
Camp Bird	0	6	6
El Oro	0	8	9
Esperanza	0	10	3
Mexico Mines	4	0	0
Nechi, pfd.	0	12	0
Oroville	0	15	6
Santa Cer t'dis	0	10	0
Tomboy	0	18	9

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.850		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.448
March	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.000	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. ¡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic†		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.